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WORKSHOP MANUAL FOR TRACTOR
L3010/L3410/L3710/L4310/L4610

Part Number: 9789712191

SAFETY DECALS

- **The following safety decals are installed on the machine.**
  If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

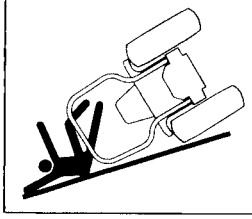
①Part No. TA040-4965-2

⚠ DANGER

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.
1. Do not start engine by shorting across starter terminals or bypassing the safety start switch. Machine may start in gear and move if normal starting circuitry is bypassed.
2. Start engine only from operator's seat with transmission and PTO OFF. Never start engine while standing on the ground.

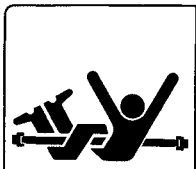
②Part No. TA040-4932-2

⚠ WARNING



TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:
1. Kubota recommends the use of a Roll-Over Protective Structures (ROPS) and seat belt in almost all applications.
2. Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
3. Never use just the seat belt or just the ROPS. They must be used together. For further details, consult your Operator's Manual or your local dealer.

③Part No. TA040-4959-3



⚠ WARNING

TO AVOID PERSONAL INJURY.
1. Keep PTO shield in place at all times.
2. Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer.
3. For trailing PTO-driven implements, set drawbar at towing position. (see operator's manual)

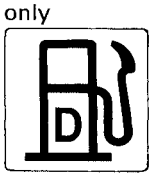
④Part No. TA240-4991-1 【HST type】

⚠ WARNING

Do not start engine with speed set lever engaged or control pedal operated.

⑤Part No. TA040-4956-2

Diesel fuel only



No fire

⑥Part No. TA040-4934-1

⚠ WARNING

TO AVOID PERSONAL INJURY:
Do not operate rear-PTO driven implements and mid-PTO driven implements at the same time.

⑦Part No. TA040-4935-1

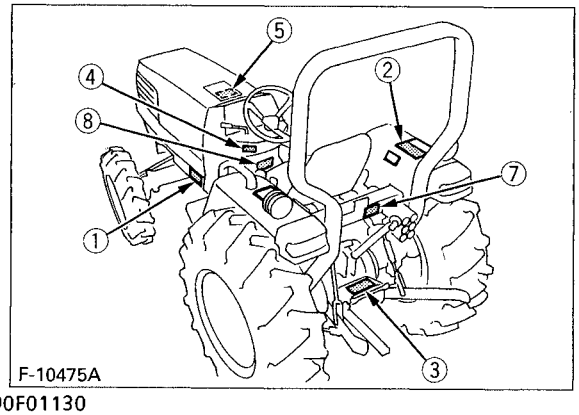
⚠ WARNING

TO AVOID PERSONAL INJURY:
1. Attach pulled or towed loads to the drawbar only.
2. Use the 3-point hitch only with equipment designed for 3-point hitch usage.

⑧Part No. 35080-6528-2

⚠ CAUTION

Pull the engine stop knob back and hold it until the engine stops in case of emergency.



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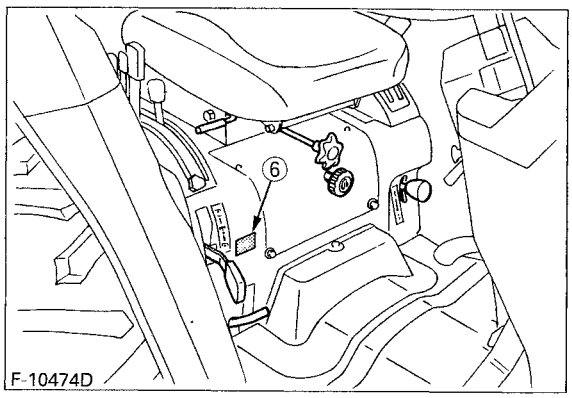


F-10474D

12190F01130

TRAVELING SPEEDS (WITH CREEP GEAR)

(at rated engine rpm)

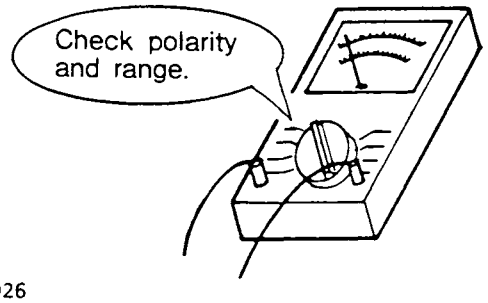
Model				L3010		L3410		L3710		L4310	
Tire size (Rear)				11.2-24		12.4-24		13.6-24		14.9-24	
	Creep speed shift lever	Hi-Lo shift lever	Main shift lever	km/h	mph	km/h	mph	km/h	mph	km/h	mph
Forward		 (Low)	1	0.17	0.11	0.18	0.11	0.16	0.10	0.16	0.10
			2	0.24	0.15	0.26	0.16	0.22	0.14	0.23	0.14
			3	0.39	0.24	0.41	0.26	0.36	0.22	0.37	0.23
			4	0.58	0.36	0.61	0.38	0.53	0.33	0.55	0.34
		 (High)	1	0.82	0.51	0.87	0.54	0.76	0.48	0.78	0.49
			2	1.16	0.72	1.23	0.77	1.07	0.67	1.11	0.69
			3	1.88	1.17	1.99	1.24	1.74	1.09	1.80	1.13
			4	2.77	1.73	2.94	1.84	2.57	1.61	2.66	1.66
	 (Off)	 (Low)	1	1.51	0.94	1.61	1.01	1.41	0.88	1.45	0.91
			2	2.14	1.34	2.28	1.42	1.99	1.24	2.06	1.29
			3	3.48	2.18	3.69	2.31	3.23	2.02	3.34	2.09
			4	5.13	3.21	5.46	3.41	4.77	2.98	4.93	3.08
		 (High)	1	7.28	4.55	7.74	4.84	6.77	4.23	7.00	4.38
			2	10.31	6.44	10.95	6.84	9.58	5.99	9.90	6.19
			3	16.73	10.46	17.78	11.11	15.55	9.72	16.07	10.04
			4	24.71	15.44	26.26	16.41	22.96	14.35	23.74	14.84
Reverse		 (Low)	1	0.16	0.10	0.16	0.10	0.15	0.09	0.15	0.09
			2	0.22	0.14	0.24	0.15	0.20	0.13	0.21	0.13
			3	0.36	0.22	0.38	0.23	0.33	0.21	0.34	0.21
			4	0.53	0.33	0.56	0.35	0.49	0.30	0.50	0.32
		 (High)	1	0.75	0.47	0.80	0.50	0.70	0.44	0.71	0.45
			2	1.06	0.66	1.13	0.70	0.98	0.61	1.02	0.64
			3	1.72	1.08	1.82	1.14	1.59	1.00	1.65	1.03
			4	2.54	1.59	2.69	1.68	2.36	1.47	2.44	1.52
	 (Off)	 (Low)	1	1.38	0.87	1.48	0.92	1.29	0.81	1.33	0.83
			2	1.96	1.23	2.09	1.31	1.82	1.14	1.89	1.18
			3	3.19	1.99	3.38	2.11	2.96	1.85	3.06	1.91
			4	4.70	2.94	5.00	3.13	4.37	2.73	4.52	2.82
		 (High)	1	6.67	4.17	7.09	4.43	6.21	3.88	6.42	4.01
			2	9.45	5.91	10.04	6.27	8.78	5.49	9.07	5.67
			3	15.33	9.58	16.30	10.19	14.25	8.91	14.73	9.21
			4	22.65	14.16	24.07	15.04	21.05	13.15	21.76	13.60

[HST Type]

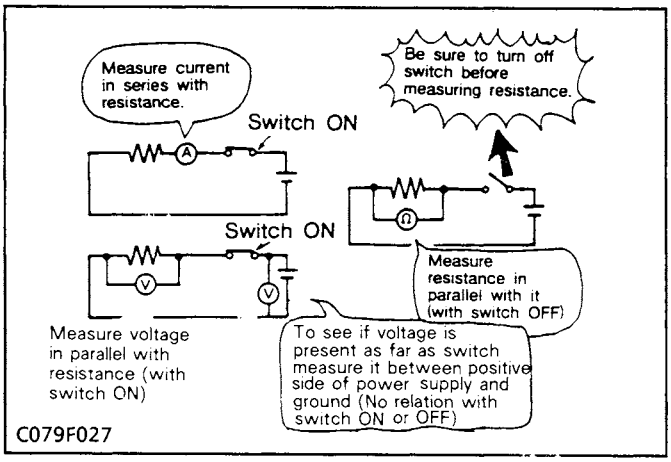
Model		L3010		L3410		L3710		L4310	
Tire size (Rear)		12.4-24		12.4-24		13.6-24		14.9-24	
Forward	Hi	0 to 6.6	0 to 4.1	0 to 6.6	0 to 4.1	0 to 5.8	0 to 3.6	0 to 6.0	0 to 3.7
	Mi	0 to 12.4	0 to 7.7	0 to 12.4	0 to 7.7	0 to 10.8	0 to 6.7	0 to 11.2	0 to 7.0
	Lo	0 to 26.4	0 to 16.4	0 to 26.4	0 to 16.4	0 to 23.1	0 to 14.4	0 to 23.9	0 to 14.9
Reverse	Hi	0 to 6.6	0 to 4.1	0 to 6.6	0 to 4.1	0 to 4.6	0 to 2.9	0 to 4.8	0 to 3.0
	Mi	0 to 12.4	0 to 7.7	0 to 12.4	0 to 7.7	0 to 8.6	0 to 5.4	0 to 9.0	0 to 5.6
	Lo	0 to 21.1	0 to 13.1	0 to 21.1	0 to 13.1	0 to 18.5	0 to 11.5	0 to 19.1	0 to 11.9

■ Handling of Circuit Testers

- Use tester correctly following manual provided with tester.
- Check for polarity and range.



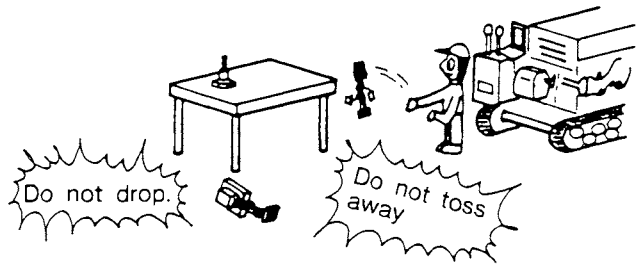
C079F026



C079F027

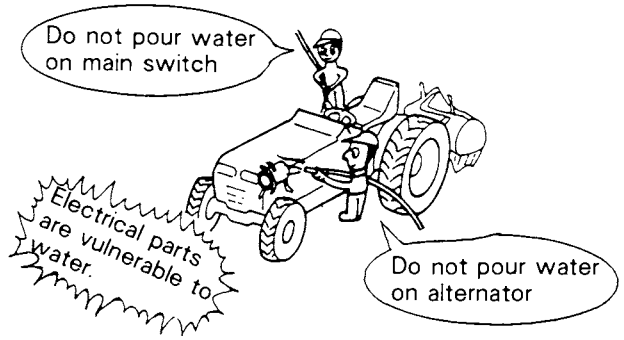
■ Handling of Parts

- Do not throw or drop electrical parts and wire harnesses.



C079F023

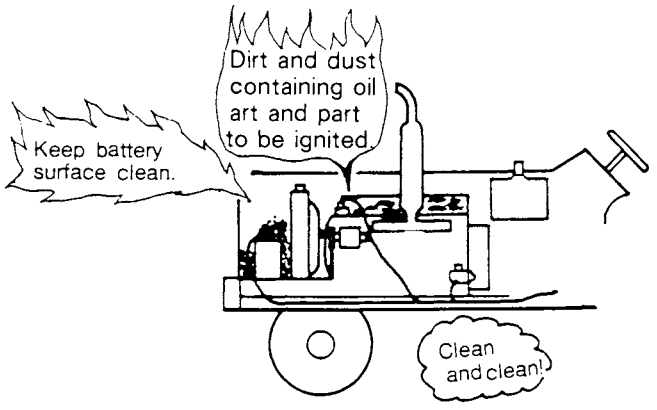
- Do not pour water on electrical parts such as main switch and alternator.



C079F025

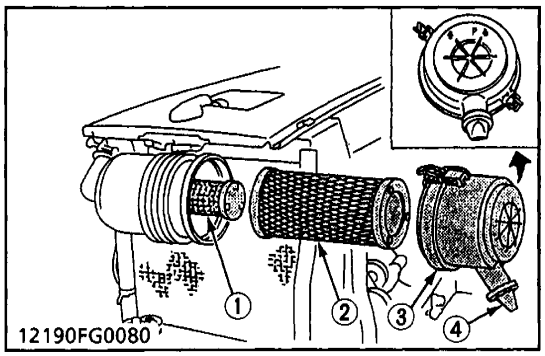
■ Oil, Dust and Dirt

- If flammable material such as fuel, or lubricant spills, wipe it off with dry piece of cloth. Do not approach it with an open flame.
- Replace fuel pipe that is aged.
- Remove dirt and dust accumulated on heated part, wire harness, battery, etc.



C079F024

(4) Check Points of Every 100 Hours



(1) Secondary Element
(2) Primary Element
(3) Cover
(4) Evecuator Valve

Changing Engine Oil

1. See page G-12.

Cleaning Air Cleaner Element

1. Remove the air cleaner cover (3) and primary element (2).
2. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 686 kPa (7 kgf/cm^2, 99 psi).
3. When carbon or oil adheres to the element, soak the element in detergent for 15 minutes then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not. (Referring to the instructions on the label attached to the element.)

■ NOTE

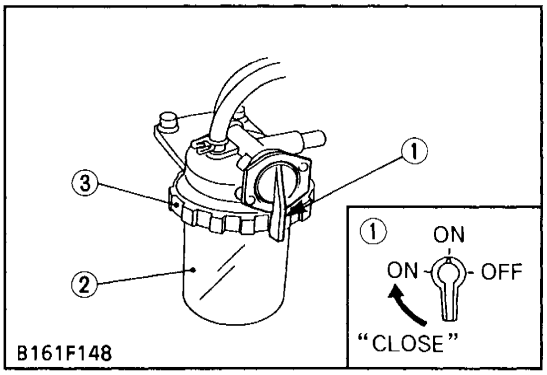
- **Every year or every 6 times of cleaning, replace the air cleaner primary element (2).**

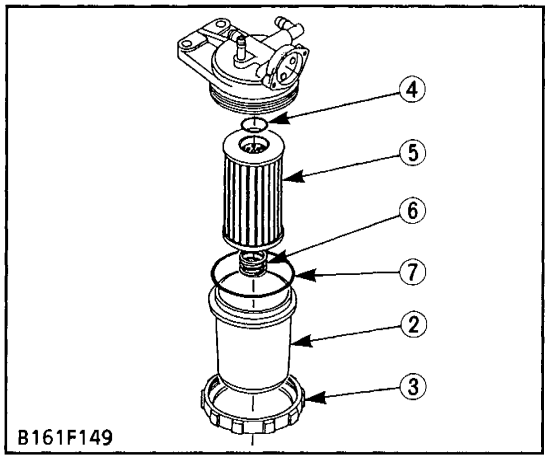
■ IMPORTANT

- **The air cleaner uses a dry element, never apply oil.**
- **Do not run the engine with filter element removed.**
- **Make sure the wing nut or bolt with rubber dust seal for the element is tight enough.**
  If it is loose, dust and dirt may be sucked in, wearing down the cylinder and piston rings earlier and thereby resulting in poor power output.

■ Evacuator Valve

1. Open the evacuator valve once a week under ordinary conditions – or daily when used in a dusty place – to get rid of large particles of dust and dirt.





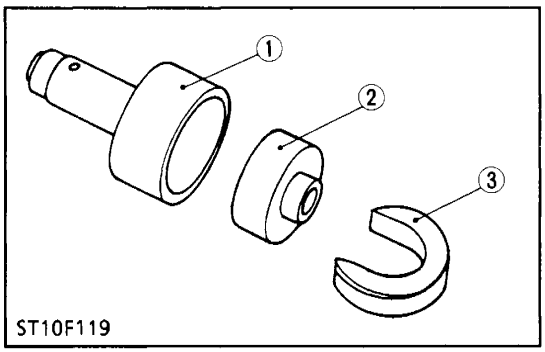
Cleaning Fuel Filter Element and Filter Bowl

1. Close the fuel filter cock (1).
2. Unscrew the retainer ring (3) and remove the filter bowl (2), and rinse the inside with kerosene.
3. Take out the element (5) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-24.)

■ IMPORTANT

- **This job should not be done in the field, but in a clean place.**
- **If dust and dirt enter the fuel, the fuel pump and injection nozzles are subject to quick wear.**
  To prevent this, be sure to clean the fuel filter bowl periodically.

(1) Fuel Filter Cock
(2) Filter Bowl
(3) Retainer Ring
(4) O-ring
(5) Filter Element
(6) Spring
(7) O-ring

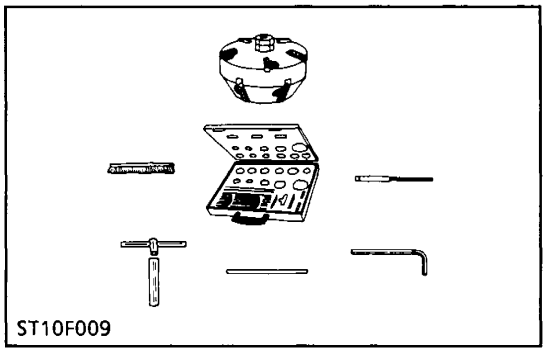


ST10F119

Auxiliary Socket For Fixing Crankshaft Sleeve

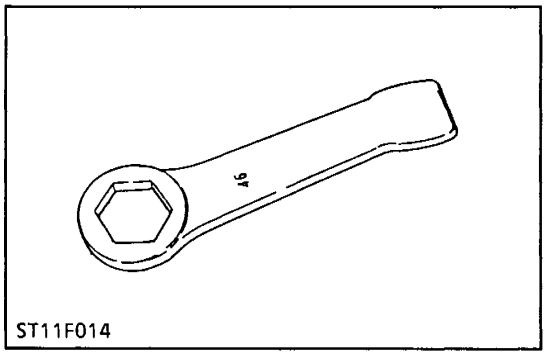
Code No : 07916-32091
Application : Use to fix the crankshaft sleeve of the diesel engine.

(1) Auxiliary Socket for Pushing
(2) Sleeve Guide
(3) Stopper


ST10F009

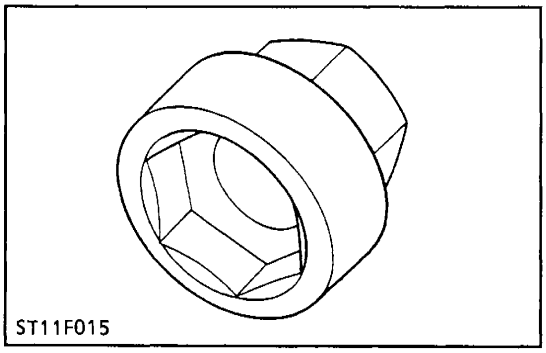
Valve Seat Cutter

Code No : 07909-33102
Application : Use to reseat valves.
Angle : 0.785 rad. (45°)
0.262 rad. (15°)
0.523 rad. (30°) – Only 50.8 mm (2.000 in.)


ST11F014

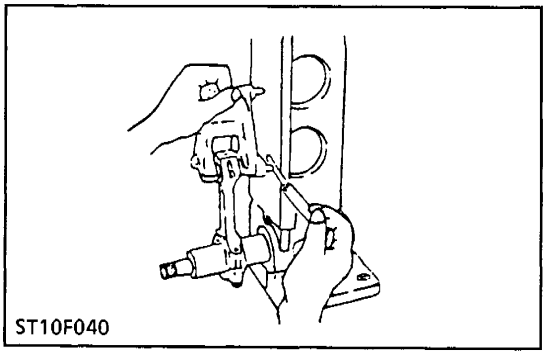
Socket Wrench 46

Code No : 07916-30901
Application : Used also for the crankshaft-nut socket 46 to tighten or loosen the crankshaft nut.


ST11F015

Crankshaft-Nut Socket 46

Code No : 07916-30821
Application : Used also for the socket wrench 46 to tighten or loosen the crankshaft nut.

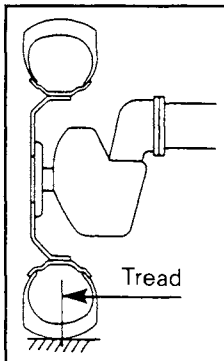

ST10F040

Connecting Rod Alignment Tool

Code No : 07909-31661
Application : Use to check the connecting rod alignment.
Applicable range : Connecting rod large end I.D. 30 to 75 mm (1.18 to 2.95 in. dia.)
Connecting rod length
65 to 330 mm (2.56 to 12.99 in.)

[4WD Type]

Front axle is not adjustable.



Models	L3010, L3410					
Tires	7.2-16 Farm	24 x 8.50-14 Turf	27 x 8.50-15 Turf	27 x 10.50- 15 Turf	29 x 12.50- 15 Turf	10-16.5 Industrial
Tread	1105 mm (43.5 in.)	1135 mm (44.7 in.)	1150 mm (45.3 in.)	1180 mm (46.5 in.)	1230 mm (48.4 in.)	1180 mm (46.5 in.)
Models	**L3710**	**L3710, L4310**				
Tires	7.2-16 Farm	8.3-16 Farm	27 x 8.50-15 Turf	27 x 10.50-15 Turf	29 x 12.50-15 Turf	10-16.5 Industrial
Tread	1155 mm (45.5 in.)		1200 mm (47.2 in.)	1230 mm (48.4 in.)	1280 mm (50.4 in.)	1230 mm (48.4 in.)

(2)-2 Rear Wheels

Rear tread can be adjusted in 6 steps depending on the model.

To change the tread

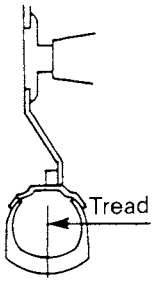
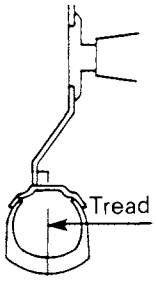
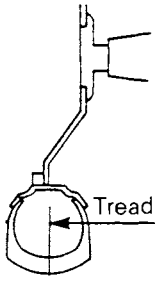
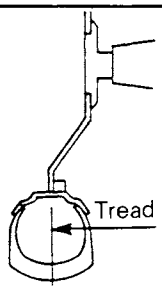
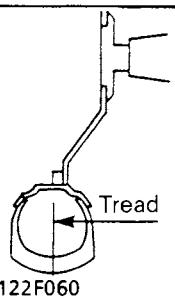
1. Lift the rear tires off the ground.
2. Follow the illustrations below to get the desired tread width.

⚠ CAUTION

- **When working on slopes or working with trailer, set the wheel tread as wide as practical for the job for maximum stability.**

■ IMPORTANT

- **Always attach tires as shown in the drawings below.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **Do not use tires larger than specified.**

Models					 B122F060
L3010 11.2 – 24 Farm		1120 mm (44.1 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1405 mm (55.3 in.)
L3010, L3410 12.4 – 24 Farm		1120 mm (44.1 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1405 mm (55.3 in.)
L3710 12.4 – 24 Farm	1150 mm (45.3 in.)	1235 mm (48.6 in.)	1335 mm (52.6 in.)	1415 mm (55.7 in.)	1515 mm (59.6 in.)
L3710, L4310 13.6 – 24 Farm	1180 mm (46.5 in.)	1200 mm (47.2 in.)	1300 mm (51.2 in.)	1450 mm (57.1 in.)	1545 mm (60.8 in.)
L3710, L4310 14.9 – 24 Farm	1180 mm (46.5 in.)	1200 mm (47.2 in.)	1300 mm (51.2 in.)	1450 mm (57.1 in.)	1545 mm (60.8 in.)

MECHANISM

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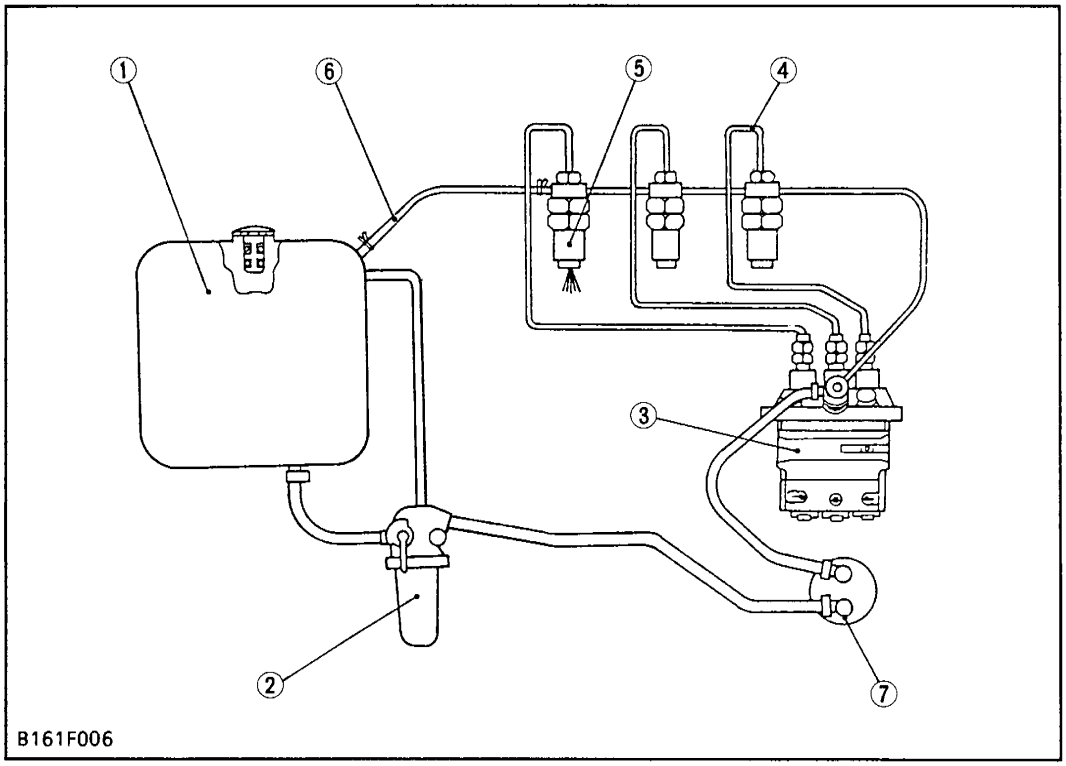
(6) Governor 1-M14

[5] FUEL SYSTEM

(1) Fuel Lines



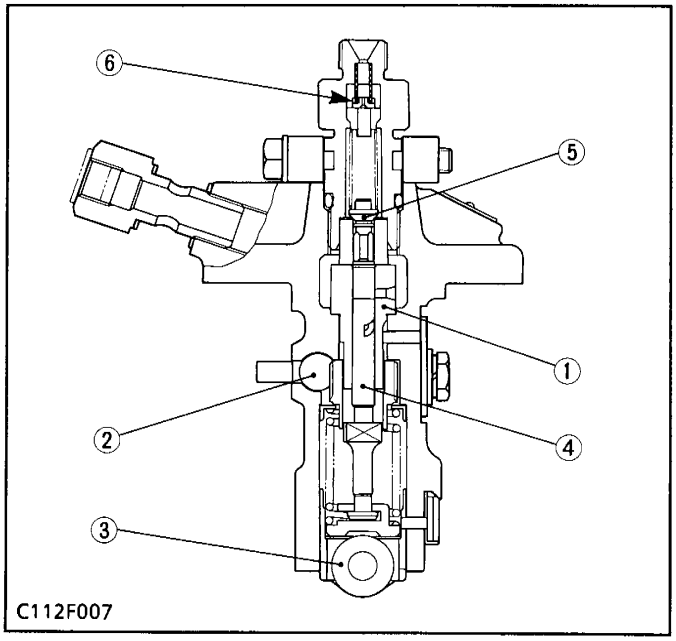
(1) Fuel Tank
(2) Fuel Filter
(3) Injection Pump
(4) Injection Pipe
(5) Injection Nozzle
(6) Fuel Overflow Pipe
(7) Fuel Lift Pump

Fuel from the fuel tank (1) passes through the fuel filter (2), and then enters the injection pump (3) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm^2, 1991 to 2062 psi), of the injection nozzle (5) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (5) lubricates the moving parts of the plunger inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (6) from the upper part of the nozzle holder.

(2) Fuel Injection Pump



A Bosch type mini pump is used for the injection pump. It is small, lightweight and easy to handle.

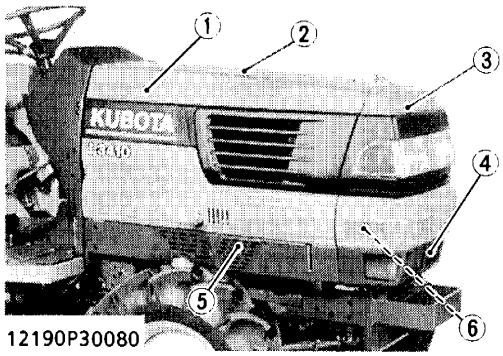
The plunger (4) with a right-hand lead reciprocates via the tappet roller (3) by means of the camshaft fuel cam, causing the fuel to be delivered into the injection nozzle.

(1) Cylinder
(2) Control Rack
(3) Tappet Roller
(4) Plunger
(5) Delivery Valve
(6) Dumping Valve

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Bleed	G-24
	• Water in the fuel system	Change fuel and repair or replace fuel system	–
	• Fuel pipe clogged	Clean	–
	• Fuel filter clogged	Change	G-20
	• Excessively high viscosity of fuel or engine oil at low temperature	Use the specified fuel or engine oil	G-8
	• Fuel with low cetane number	Use the specified fuel	G-8
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	1-S17
	• Incorrect injection timing	Adjust	1-S45
	• Fuel camshaft worn	Replace	1-S28
	• Injection nozzle clogged	Clean	1-S46, S47
	• Injection pump malfunctioning	Repair or replace	1-S26, S47
	• Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S15
	• Improper valve timing	Correct or replace timing gear	1-S28
	• Piston ring and cylinder worn	Replace	1-S36, S41
	• Excessive valve clearance	Adjust	1-S16
Starter Does Not Run	• Battery discharged	Charge	9-S7
	• Starter malfunctioning	Repair or replace	9-S11 to S14
	• Main switch malfunctioning	Repair or replace	9-S8, S9
	• Shuttle limit switch or PTO limit switch improperly adjusted or defective	Repair ro replace	9-S9
	• Starter relay defective	Replace	9-S9
	• Wiring disconnected	Connect	9-M1, M2
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Change	G-20
	• Air cleaner clogged	Clean or change	G-17
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	1-S17
	• Injection pump malfunctioning	Repair or replace	1-S26, S47
	• Incorrect nozzle injection pressure	Adjust	1-S46
	• Injection nozzle stuck or clogged	Repair or replace	1-S17, S47
	• Governor malfunctioning	Repair	1-S26, S28
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to the specified level	1-S10
	• Piston ring and cylinder worn or stuck	Repair or replace	1-S36, S41
	• Incorrect injection timing	Adjust	1-S45
	• Deficient compression	Adjust top clearance	1-S15
Either Black or Dark Gray Exhaust Gas Is Observed	• Overload	Lessen the load	–
	• Low grade fuel used	Use the specified fuel	G-8
	• Fuel filter clogged	Change	G-20
	• Air cleaner clogged	Clean or change	G-17
	• Deficient nozzle injection	Repair or replace the nozzle	1-S17, S47

(2) Separating Panel Frame Assembly

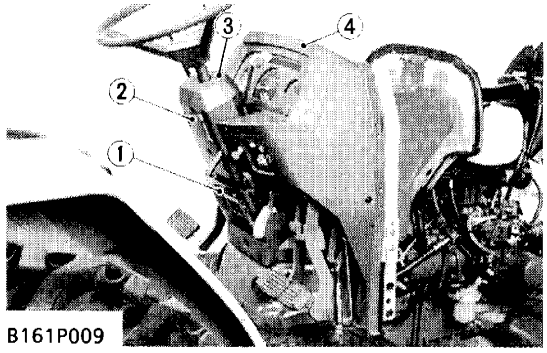


12190P30080

Preparation 1

1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

(1) Side Cover (RH, LH)
(2) Bonnet
(3) Front Mask
(4) Front Grille
(5) Side Skirt (RH, LH)
(6) Battery Negative Code



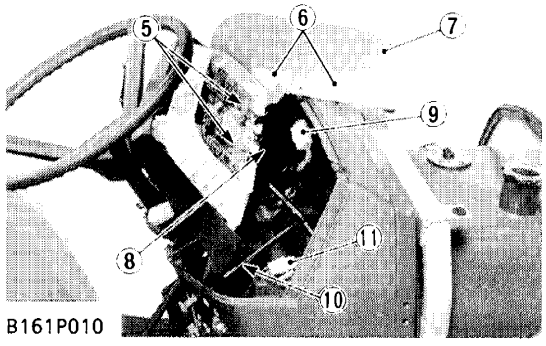
B161P009

Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7) and disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and combination switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

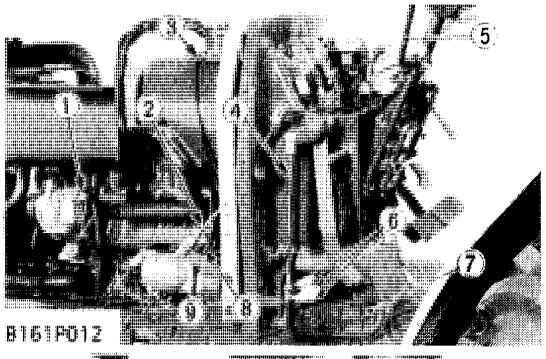
■ **NOTE**

- **Do not remove the seals (6) on the meter panel cover (7).**



B161P010

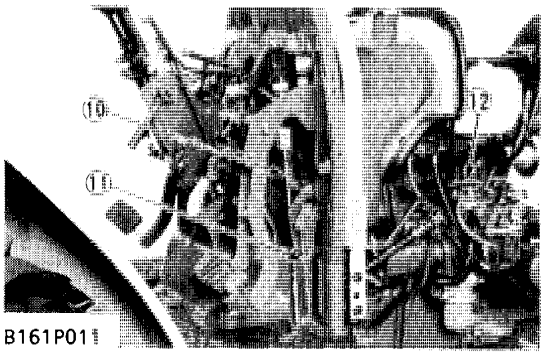
(1) Panel Under Cover
(2) Steering Post Cover
(3) Steering Post Cover
(4) Meter Panel
(5) Connectors
(6) Seals
(7) Meter Panel Cover
(8) Meter Cable
(9) Combination Switch Connector
(10) Engine Stop Cable
(11) Main Switch Connector



B161P012

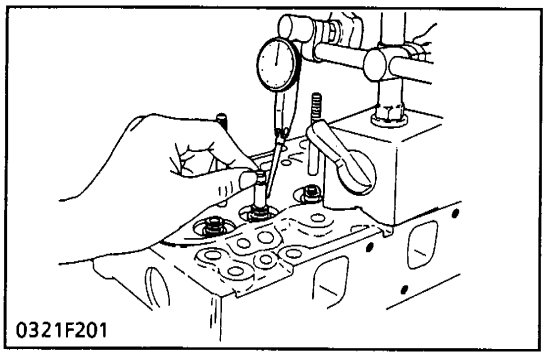
Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1), jumper leads for fuel level sensor (3) and starter (9).



B161P011

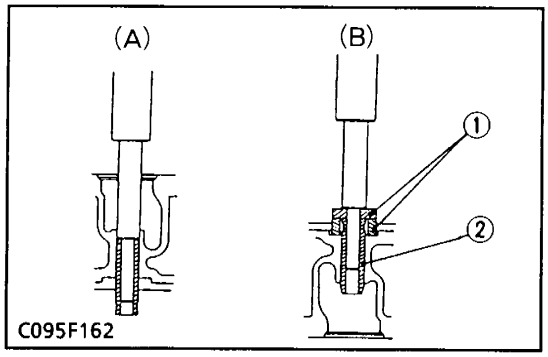
(1) 2P Connector for Alternator
(2) Clutch Rod
(3) Jumper Lead for Fuel Level Sensor
(4) Brake Rod (LH)
(5) Shuttle Shift Lever
(6) Connectors
(7) Panel Frame Cover
(8) Jumper Lead for Oil Switch
(9) Jumper Lead for Starter
(10) Brake Rod (RH)
(11) Foot Accelerator Rod
(12) Accelerator Rod

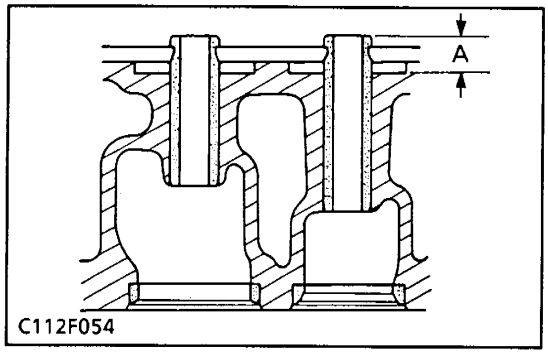


Valve Guide Clearance

1. Remove carbon from the valve guide.
2. After making sure that the valve stem is straight, insert the valve into the valve guide.
3. Measure the valve guide clearance with a dial gauge.
4. If the measurement exceeds the allowable limit, replace the valve guide and the valve.

Valve guide clearance	Factory spec.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.1 mm 0.0039 in.
Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
Valve stem O.D.	Factory spec.	7.960 to 7.975 mm 0.31339 to 0.31398 in.





Replace the Valve Guide

1. Remove the spacer (1).
2. Press out the used valve guide from the cylinder head's lower end.
3. Before pressing in, apply oil on the outer surface of the valve guide, place a spacer of the specified protrusion allowance (A) on the cylinder head, and press in the spacer from above.
4. After press-fitting, finish the valve guide by means of reamer machining to specified dimension.

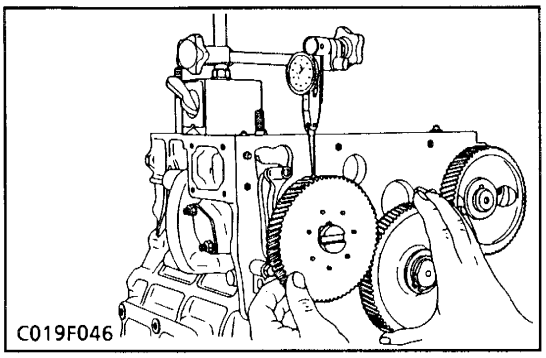
■ NOTE

- **Be careful not to strike valve guides with a hammer, etc. during replacement.**

Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
Valve guide protrusion	Factory spec.	9.8 to 10.2 mm 0.39 to 0.40 in.

[A] Take Out **[B] Insert**

(1) Spacer (2) Valve Guide


C019F046

Timing Gear Backlash

1. Set a dial indicator (lever type) with its tip on the gear tooth.
2. Move the gear to measure the backlash, holding its mating gear.
3. If the backlash exceeds the allowable limit, check the oil clearance of the shafts and gear.
4. If the oil clearance is proper, replace the gear.

Crank gear / Idle gear	Factory spec.	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.
	Allowable limit	0.15 mm 0.0059 in.
Idle gear / Cam gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Idle gear / Injection pump gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Crank gear / Oil pump gear	Factory spec.	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.
	Allowable limit	0.15 mm 0.0059 in.

[4] CRANKCASE

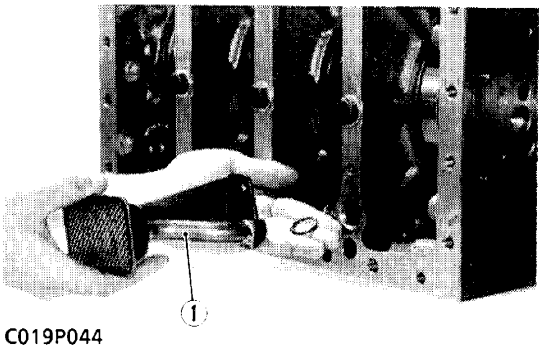
DISASSEMBLING AND ASSEMBLING

Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page 1-S17 to 1-S19.)

Timing Gears

1. Remove the timing gears. (See page 1-S25 to 1-S28.)



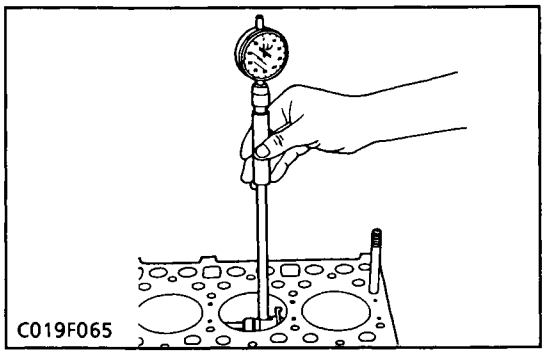
C019P044
(1) Oil Filter **1**

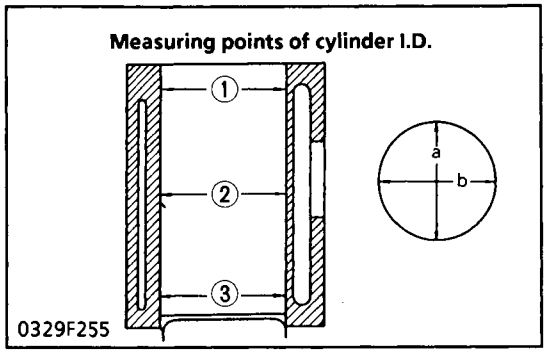
Oil Pan and Oil Filter 1

1. Lay the engine on the engine cradle on its side.
2. Remove the oil pan mounting screws.
3. Detach the oil pan by lightly tapping the groove of the pan with a wooden hammer.
4. Remove the mounting screw of oil filter 1 (1).
5. Detach oil filter 1, being careful of the O-ring.

(When reassembling)

- After cleaning the oil filter 1 (1), check to see that the filter mesh is clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- After checking to see that the O-ring is securely installed, attach the oil filter 1 (1).





(a) Right-angle to the Piston Pin
(b) Parallel to the Piston Pin

(1) Top
(2) Middle
(3) Bottom (Skirt)

Wear of Cylinder

1. Set a cylinder gauge and adjust it to the reference value of the cylinder I.D. with an outside micrometer.
2. To find out the maximum wear, measure the diameters at six points on the cylinder with the cylinder gauge, as shown below.

■ NOTE

- **When the cylinder is worn beyond the allowable limit, rebore and hone it by 0.5 mm (0.0197 in.).**
  - **For the finish dimensions of the oversized cylinder, refer to the table below.**
  - **The cylinder which has been oversized by 0.5 mm (0.0197 in.) should use a piston and ring of the same oversize. (See the Table 2)**
- **When the oversized cylinder is worn beyond the allowable limit, replace the cylinder block.**

Cylinder I.D.	D1503	Factory spec.	83.000 to 83.022 mm 3.26771 to 3.26858 in.
		Allowable limit	83.17 mm 3.2744 in.
	V1903	Factory spec.	80.000 to 80.022 mm 3.14960 to 3.15047 in.
		Allowable limit	80.17 mm 3.1563 in.
	D1703 V2203	Factory spec.	87.000 to 87.022 mm 3.4252 to 3.4261 in.
		Allowable limit	87.17 mm 3.4319 in.

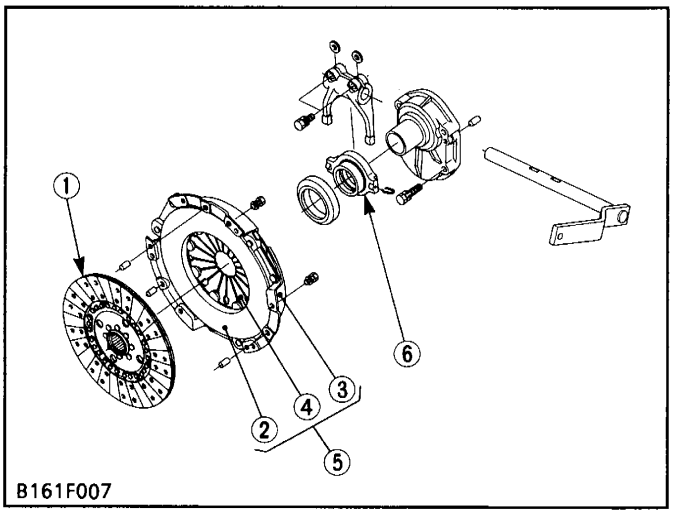
Table 1

Model	Oversized Cylinder I.D.	Finishing
D1503	83.500 to 83.522 mm 3.28740 to 3.28826 in.	Hone to 1.2 to 2.0 μR max.
V1903	80.500 to 80.522 mm 3.16929 to 3.17015 in.	
D1703 V2203	87.500 to 87.522 mm 3.44488 to 3.44574 in.	

Table 2

Oversize	Name of parts	Mark
0.5 mm 0.0197 in.	Piston 05	05 OS
	Piston ring 05 assembly	

[1] FEATURES



B161F007

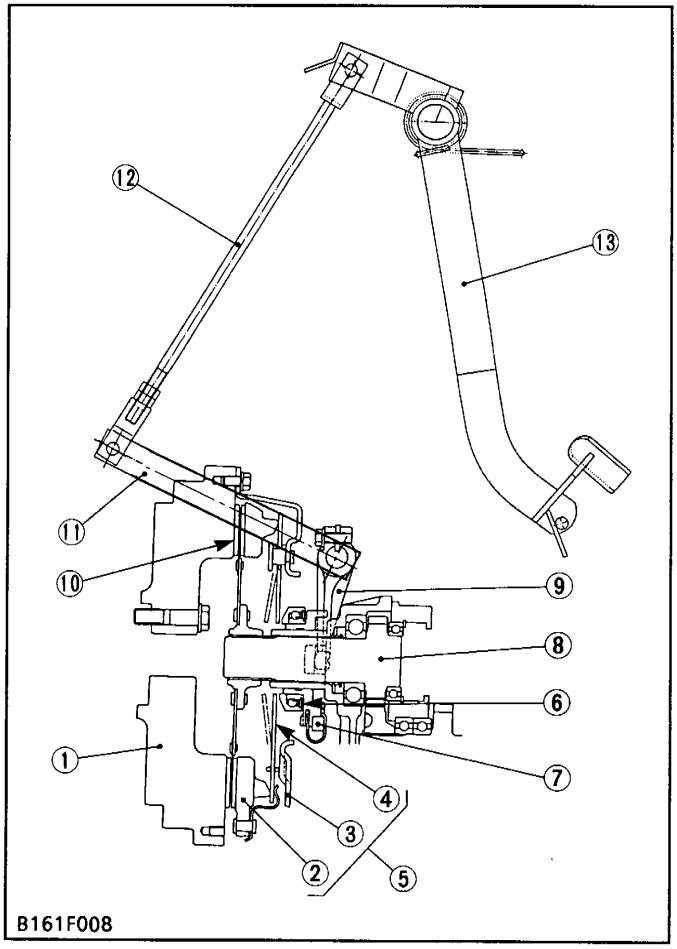
This tractor is used dry single plate type clutch.

The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

When the clutch pedal is depressed, the clutch is disengaged and when it is released, the clutch is engaged and power from the engine is transmitted to the transmission.

(1) Clutch Disc
(2) Pressure Plate
(3) Clutch Cover
(4) Diaphragm Spring
(5) Pressure Plate Assembly
(6) Release Hub

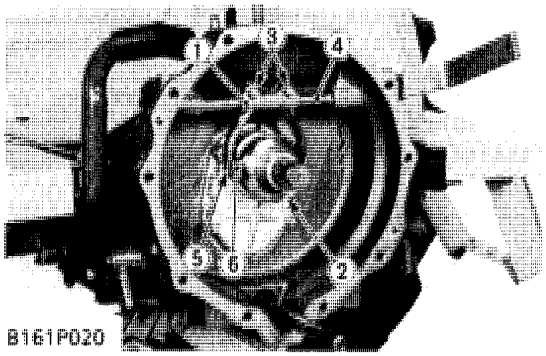
[2] LINKAGE MECHANISM



B161F008

This tractor uses hanging type clutch pedal to have wider space about the platform.

(1) Flywheel
(2) Pressure Plate
(3) Clutch Cover
(4) Diaphragm Spring
(5) Pressure Plate Assembly
(6) Release Bearing
(7) Release Hub
(8) Gear Shaft
(9) Release Fork
(10) Clutch Disc
(11) Clutch Lever
(12) Clutch Rod
(13) Clutch Pedal



(1) Release Fork
(2) Release Bearing
(3) Setting Screws
(4) Clutch Lever
(5) Snap Pins
(6) Release Holder

Release Holder and Clutch Lever

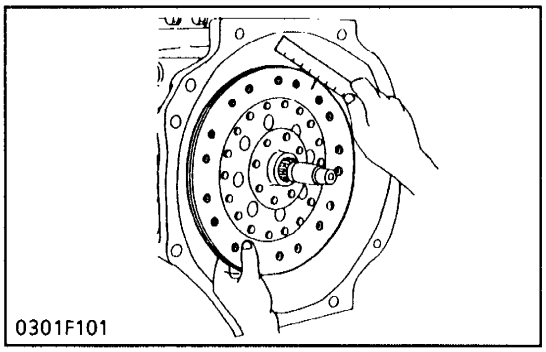
1. Draw out the clutch release holder (6) and the release bearing (2) as a unit.
2. Remove the release fork setting screws (3).
3. Draw out the clutch lever (4) to remove the release fork (1).

(When reassembling)

- Make sure the direction of the release fork (1) is correct.
- Inject grease to the release holder (6).
- Be sure to set the snap pins (5).

Tightening torque	Release fork setting screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

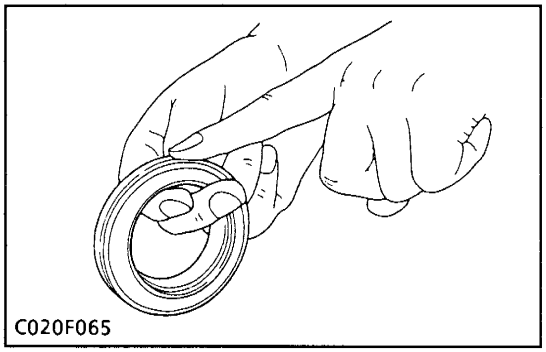
SERVICING



Backlash between Clutch Disc Boss and Gear Shaft

1. Mount the clutch disc to the gear shaft.
2. Hold the gear shaft so that it may not turn.
3. Rotate disc lightly and measure the displacement around the disc edge.
4. If the measurement exceeds the allowable limit, replace the disc.

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.

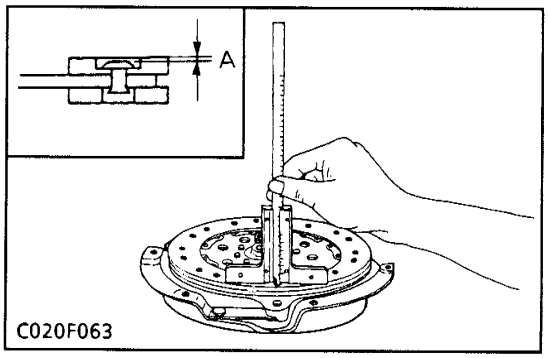


Thrust Ball Bearing

1. Remove the thrust ball bearing from release holder with a puller.
2. Check for abnormal wear on contact surface.
3. Hold bearing inner race and rotate outer race, while applying pressure to it.
4. If the bearing rotation is rough or noisy, replace the bearing.

■ **NOTE**

- **Do not depress outer race, when installing thrust ball bearing.**



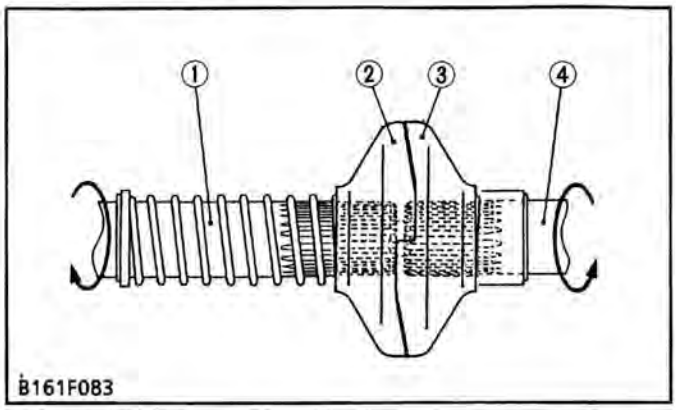
[A] More than 0.3 mm (0.012 in.)

Clutch Disc Wear

1. Measure the depth from clutch disc surface to the top of rivet at least 10 points with a depth gauge.
2. If the depth is less than the allowable limit, replace the disc.
3. If oil is sticking to clutch disc, or disc surface is carbonized, replace the disc.
   In this case, inspect transmission gear shaft oil seal, engine rear oil seal and other points for oil leakage.

Disc surface to rivet top (Depth)	Allowable limit	0.3 mm 0.012 in.

(6) One-way Clutch



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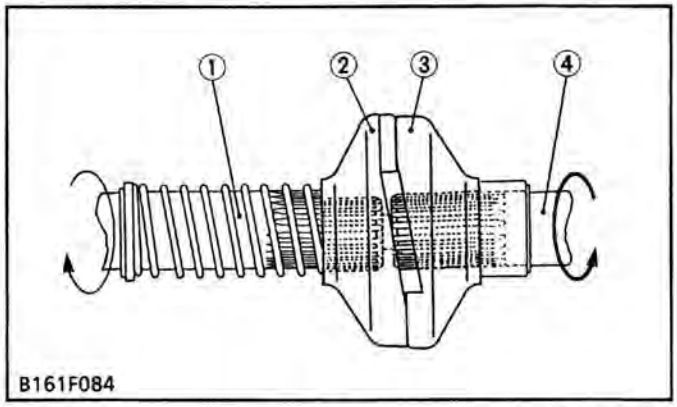


B161F084

The transmission PTO type tractors are equipped with a one-way clutch.

The one-way clutch is located between the PTO counter shaft (1) and the PTO gear shaft (4). It is composed of a pair of slant cams and a clutch spring.

One of the slant cams is splined to the PTO counter shaft (1), and the other is splined to the PTO gear shaft (4).

These two slant cams are engaged with each other by the force of the clutch spring. While the PTO counter shaft (1) is driving the PTO gear shaft (4), these two slant cams will remain engaged.

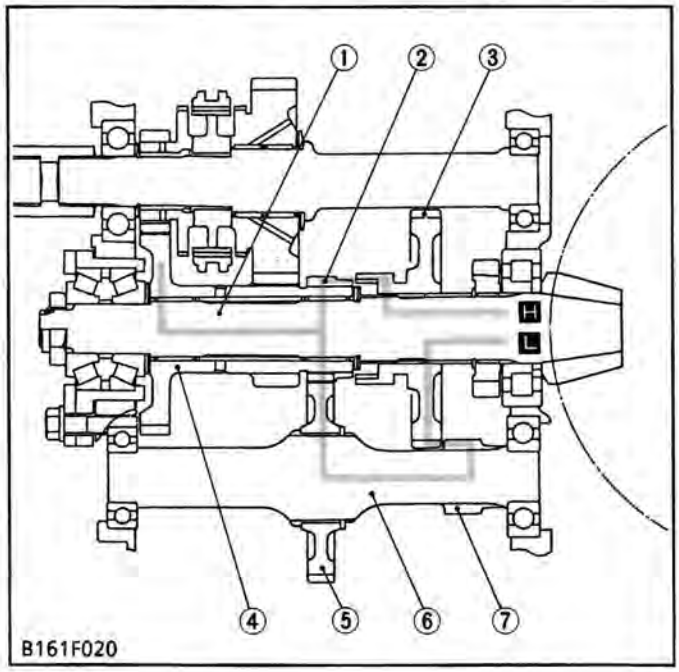
However, when the PTO shaft drives a rotary mower, for example, and if the engine speed is lowered, the slant cam (2), (3) on the PTO gear shaft (4) will overrun.

This overrunning is caused by the inertia of the mower's blades. Then, engagement will not take place until the PTO counter shaft (1) is running faster than the PTO gear shaft (4).

In this way, the one-way clutch protects the transmission and engine against damage, by allowing the PTO shaft, PTO drive shaft and PTO gear shaft (4) to overrun if PTO shaft overspeeds.

(1) PTO Counter Shaft
(2) Slant Cam
(3) Slant Cam
(4) PTO Gear Shaft

(7) Creep Speed Shift Section (Option)



B161F020

Creep speed section is located under the Hi-Lo range shift section to reduce a travelling speed. It is shifted by the creep shift lever.

The power is transmitted as follows.

[L] Low Speed (Creep Speed)

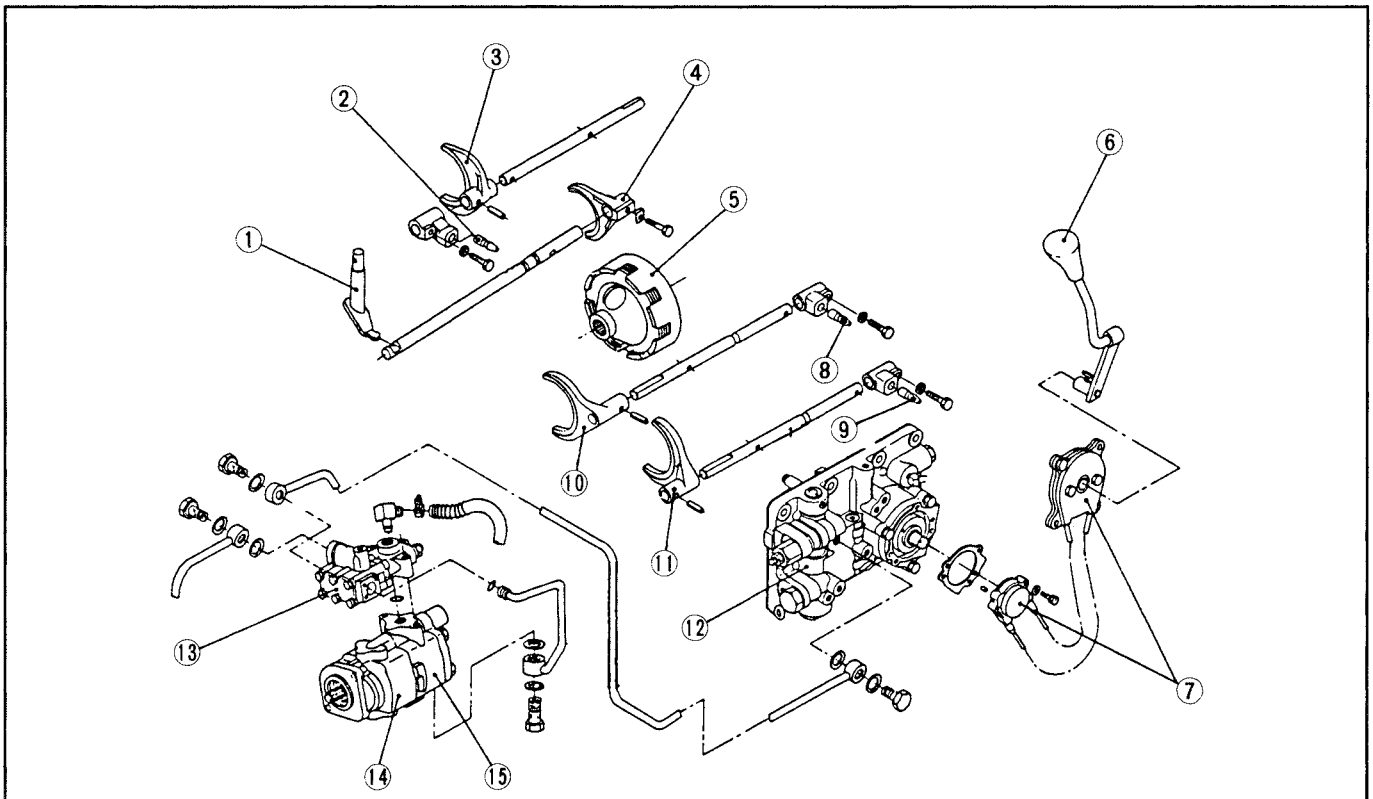
42T-16T Gear (4) → 18T Gear (2) → 41T Gear (5) → Creep Gear Shaft (6) → 12T Gear (7) → 47T Gear (3) → Spiral Bevel Pinion (1).

[H] High Speed (Normal Speed)

42T-16T Gear (4) → 18T Gear (2) → 47T Gear (3) → Spiral Bevel Pinion (1).

(1) Spiral Bevel Pinion
(2) 18T Gear (42T-16T-18T Gear)
(3) 47T Gear
(4) 42T-16T-18T Gear
(5) 41T Gear
(6) Creep Gear Shaft with 12T Gear
(7) 12T Gear (Creep Gear Shaft with 12T Gear)

(3) Structure



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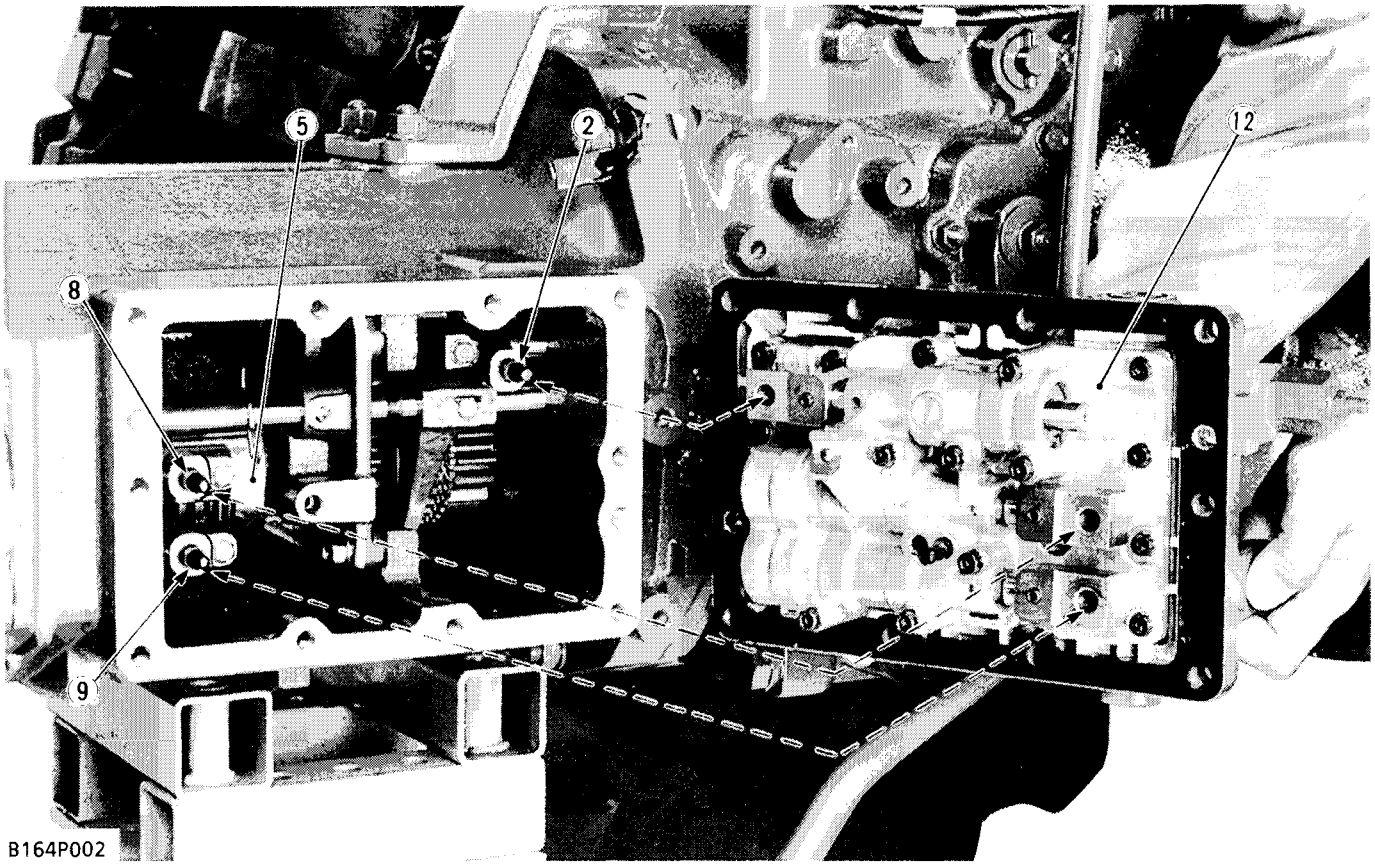
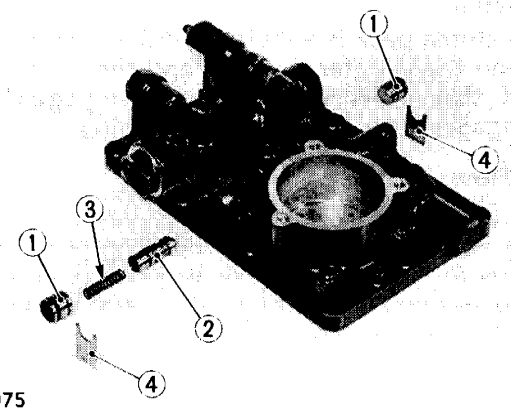


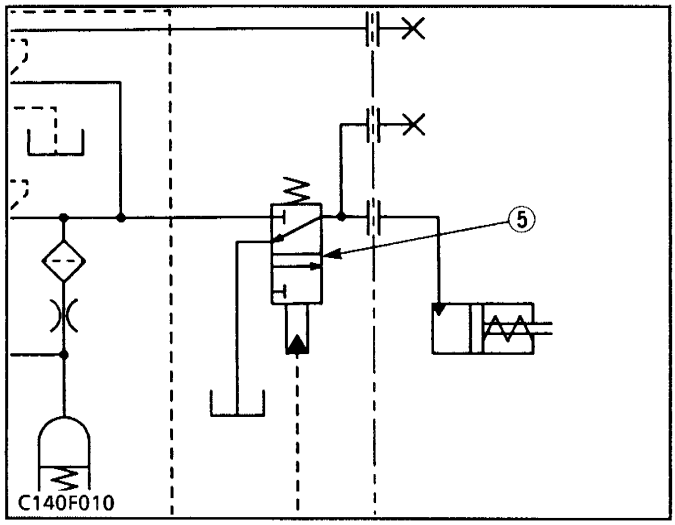
B164P002

(1) Shuttle Shift Lever
(2) Shift Pin H-L
(3) Shift Fork H-L
(4) Shuttle Shift Fork
(5) Clutch Pack
(6) Main Shift Lever
(7) Shift Cable
(8) Shift Pin 3-4
(9) Shift Pin 1-2
(10) Shift Fork 3-4
(11) Shift Fork 1-2
(12) GST Valve Assembly
(13) Regulator Valve Assembly
(14) Hydraulic Pump for Three Points Linkage
(15) Hydraulic Pump for Power Steering

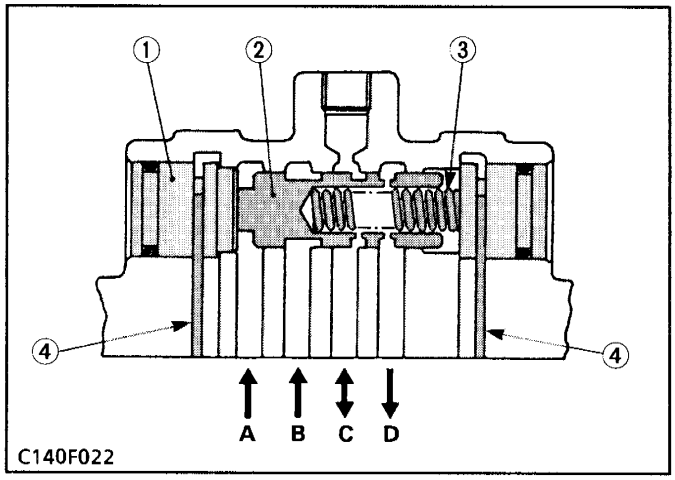
(4)-10 Clutch Valve



C143P075



C140F010



C140F022

■ Function

The clutch valve (5) changes the flow of the oil flowing to the clutch pack to carry out **"ENGAGED" / "DISENGAGED"** of the clutch pack.

■ Oil Flow

Except for the gear shifting, when the pilot circuit is pressurized, the oil of the pilot circuit flows in from the A-port to push the spool (2) to the right. Therefore, the oil from the modulate valve flows in from the B-port, flows out from the C-port, and flows to the clutch pack.

When the pilot circuit pressure is not built from the start to the end of gear shifting, the spool (2) is pushed to the left by the spring (3) to cut the oil flow from the modulate valve of the B-port, stopping the oil flow to the clutch pack.

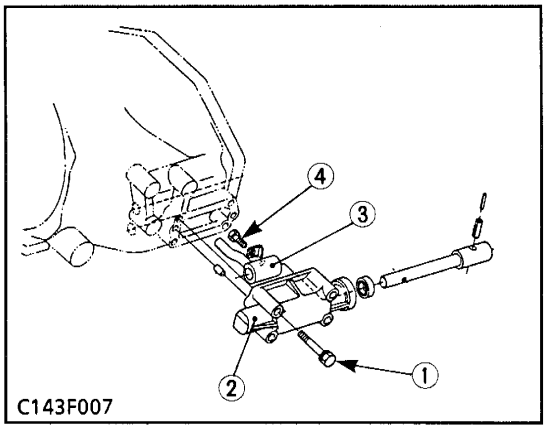
Furthermore, the oil of the clutch pack flows in from the C-port, drained from the D-port, and the clutch pack is disengaged.

A : A-Port
From Pilot Circuit
B : B-Port
From Shift Piston H-L
C : C-Port
To Clutch Pack or From Clutch Pack
D : D-Port
To Tank

(1) Plug
(2) Spool
(3) Spring
(4) Stop Plate
(5) Clutch Valve

Item		Factory Specification	Allowable Limit
Differential Case Bore (Differential Case Cover Bore) to Differential Side Gear Boss	Clearance	0.050 to 0.151 mm 0.00197 to 0.00594 in.	0.35 mm 0.0138 in.
Differential Case Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	–
Differential Case Cover Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	–
Differential Side Gear Boss	O.D.	40.388 to 40.450 mm 1.59008 to 1.59252 in.	–
Differential Pinion Shaft to Differential Pinion	Clearance	0.060 to 0.102 mm 0.00236 to 0.00402 in.	0.25 mm 0.0098 in.
Differential Pinion Shaft	O.D.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	–
Differential Pinion	I.D.	20.040 to 20.061 mm 0.78898 to 0.78980 in.	–
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.006 to 0.012 in.	0.40 mm 0.016 in.
Differential Side Gear Washer 1	Thickness	1.5 mm 0.059 in.	–
Differential Side Gear Washer 2	Thickness	1.6 mm 0.063 in.	–
Differential Side Gear Washer 3	Thickness	1.7 mm 0.067 in.	–
GST System Pressure **Condition** • Engine Idling Speed • Oil Temperature ··· 40 to 60 °C 104 to 140 °F		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm² 356 to 370 psi	–
GST Relief Valve Setting Pressure **Condition** • Engine Maximum Speed • Oil Temperature ··· 40 to 60 °C 104 to 140 °F		2.84 to 2.94 MPa 29.0 to 30.0 kgf/cm² 412 to 427 psi	–
GST Pilot Pressure **Condition** • Engine Maximum Speed • Oil Temperature ··· 40 to 60 °C 104 to 140 °F • Main Shift Lever to Be **"1st"** • Shuttle Shift Lever To Be **"Forward"** or **"Reverse"**		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm² 356 to 370 psi	–
GST Clutch Pack Pressure **Condition** • Engine Idling Speed • Oil Temperature ··· 40 to 60 °C 104 to 140 °F • Main Shift Lever **"Neutral"** to **"1st"** ~ **"8th"** • Shuttle Shift Lever **"Neutral"** to **"Forward"** and **"Reverse"**		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm² 356 to 370 psi	–
Independent PTO Operating Pressure		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm² 356 to 370 psi	–

(5) Disassembling Clutch Housing Case



C143F007

(1) Screw
(2) Main Shift Base
(3) Main Shift Arm
(4) Setting Screw

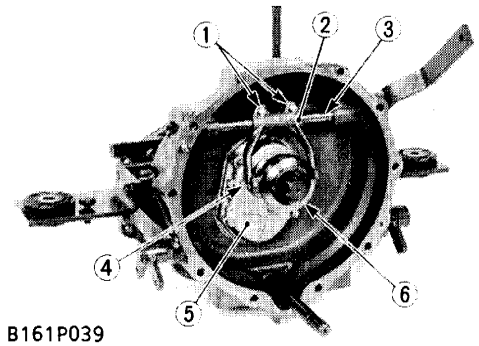
Main Shift Base (Manual Shift Transmission)

1. Remove the main shift base mounting screws (1).
2. Take out the main shift base (2) and main shift arm (3) as a unit.

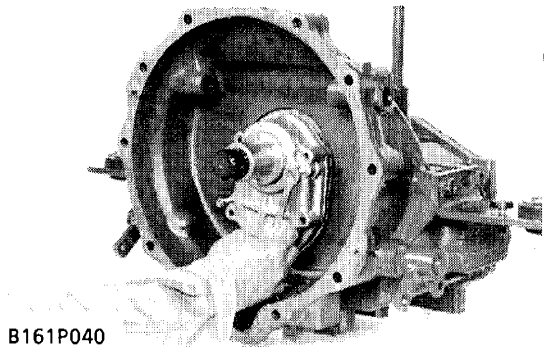
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing case and main shift base after eliminate the water, oil and stuck liquid gasket.
- The main shift arm should be fitted on to the shift fork grooves after setting the shift forks to neutral position.

Tightening torque	Main shift base mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	Main shift arm setting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs



B161P039


B161P040

Gear Shaft Case

1. Remove the release fork setting screws.
2. Draw out the clutch lever (3) to remove the release fork (2).
3. Take out the thrust ball bearing (6) and the release hub together.
4. Remove the gear shaft case mounting screws.
5. Screw down the two M6 screws into the gear shaft case (5) and pull it out.
6. Take out the gear shaft case (5).

(When reassembling)

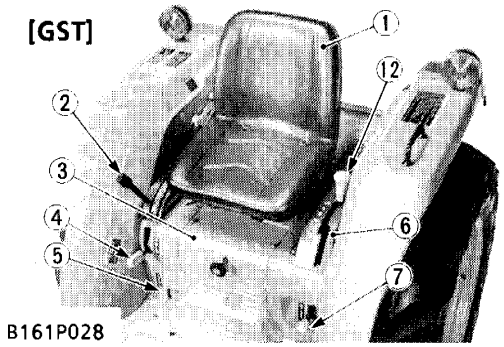
- Apply grease to the sliding surface of the clutch release hub.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint surface of the gear shaft case and clutch housing case after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Gear shaft case mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	Release fork setting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Setting Screws
(2) Release Fork
(3) Clutch Lever
(4) Snap Pin
(5) Gear Shaft Case
(6) Thrust Ball Bearing

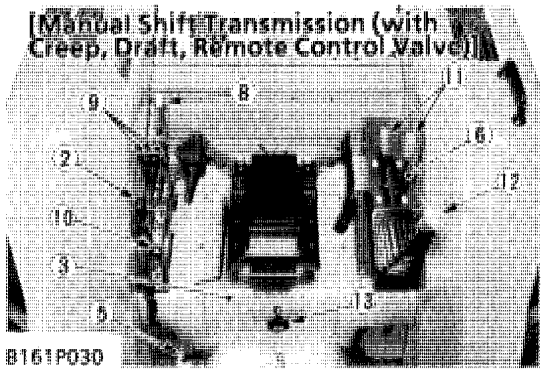
(3) Separating Rear Fenders and Platform Assembly

[GST]



B161P028

[Manual Shift Transmission (with Creep, Draft, Remote Control Valve)]



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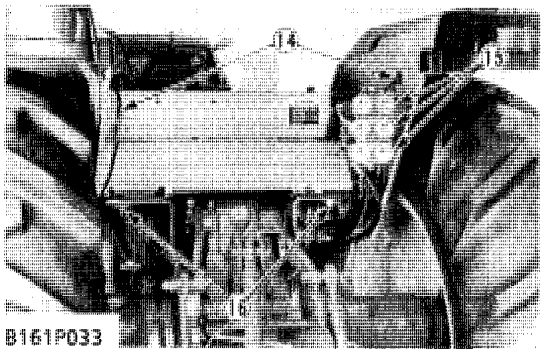
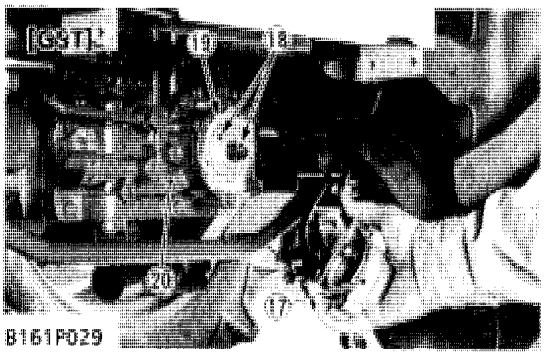


B161P033

[GST]



B161P029

Preparation

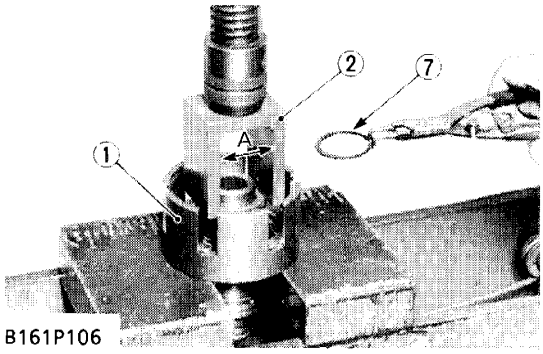
1. Take out the ROPS.
2. Remove the seat assembly (1).
3. Remove the mid PTO lever (4) (if equipped) and grips (2), (7), (8), (9), (10), (11), (12), (13).
4. Remove the shift lever guide (6).
5. Remove the seat under cover (3), and then remove the extension bar of the hydraulic lowering valve.
6. Disconnect the differential lock rod and differential lock lever (5).
7. Remove the quick couplers (15) as a unit. (If equipped.)
8. Disconnect the PTO shift cable at the PTO shift lever.
9. Loosen and remove the floor seat mounting two screws (16) and platform mounting two screws.
10. Disconnect the wiring harness (14) for hazard lights.
11. Remove the shift cable (17) as a unit at the GST valve (20) side. (GST only.)

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover (19) and shift cable. (GST only.)
- Set the main shift lever at the neutral position, align the punched marks (18), and then assemble the shift cable (17). (GST only.)
- Check and adjust the PTO shift cable. (See page 10-S28.)

Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft-lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft-lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft-lbs
	Floor seat and platform mounting screws and nuts		196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft-lbs
	Shift cable mounting screws		7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft-lbs

(1) Seat
(2) Grip
(3) Seat Under Cover
(4) Mid PTO Lever
(5) Differential Lock Lever
(6) Shift Lever Guide
(7) Grip
(8) Grip
(9) Grips
(10) Grip
(11) Grips
(12) Grip
(13) Grip
(14) Wiring Harness
(15) Quick Couplers
(16) Floor Seat Mounting Screws
(17) Shift Cable
(18) Punched Mark
(19) Rotary Valve Cover
(20) GST Valve



B161P106

Piston

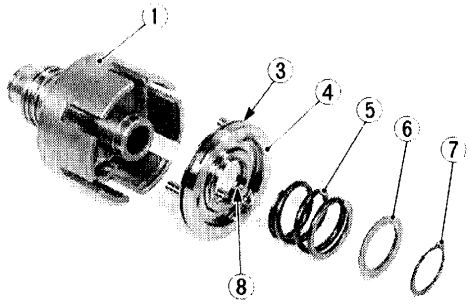
1. Press the washer (6) lightly by the hand press, using the hand made jig. (Refer to the left photo.)
2. Draw out the piston (4).

(When reassembling)

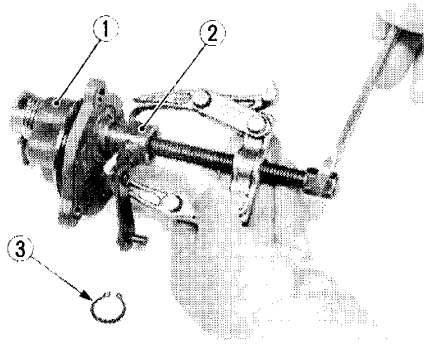
- Apply enough transmission fluid to seal rings (3), (8).

[A] 41 mm (1.6 in.)

(1) Clutch Case
(2) Jig
(3) Seal Ring
(4) Piston
(5) Spring
(6) Washer
(7) External Snap Ring
(8) Seal Ring



B161P104



B161P109

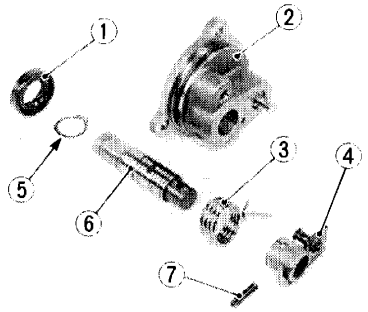
Clutch Valve Lever Arm

1. Make a marks on the spool and the lever arm (2).
2. Draw out the lever arm (2) by the bearing puller after removing the external snap ring (3).

(When reassembling)

- Assemble them with aligning the marks.

(1) Clutch Valve
(2) Lever Arm
(3) External Snap Ring



B161P110

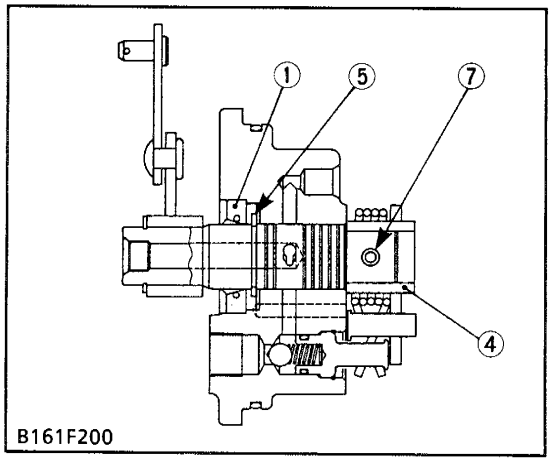
Clutch Valve Spool

1. Remove the oil seal and the external snap ring (5).
2. Draw out the spool (6).
3. Make a marks on the spool (6) and the lever (4).
4. Remove the spring (3) and tap out the spring pin (7), and then remove the lever (4).

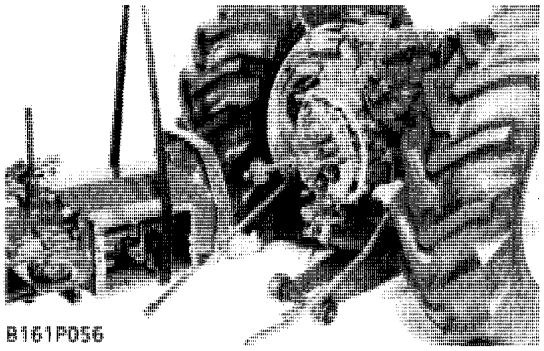
(When reassembling)

- Replace the oil seal (1).
- Assemble the spool (6) and lever (4) with aligning the marks.

(1) Oil Seal
(2) Clutch Valve Case
(3) Spring
(4) Lever
(5) External Snap Ring
(6) Spool
(7) Spring Pin



B161F200


B161P056

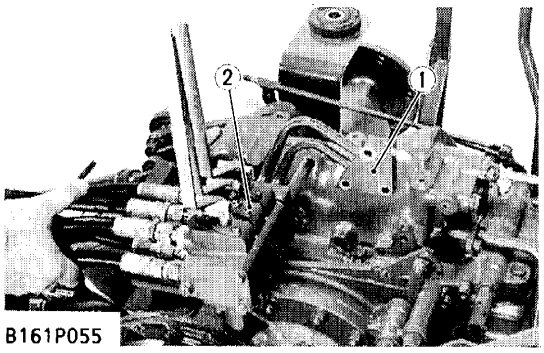
Separating Mid Case and Transmission Case

1. Separate the mid case and transmission case after removing the their mounting screws.

(When reassembling)

- Confirm inserting the PTO shaft to one-way clutch firmly with turning the PTO shaft.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing and mid case after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Mid case and transmission case mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Mid case and transmission case mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs



B161P055

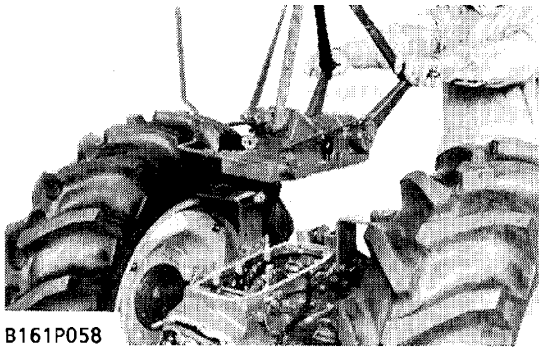
Auxiliary Control Valves (If Equipped)

1. Loosen and remove the hydraulic pipe mounting three screws.
2. Loosen and remove the auxiliary control valves mounting two screws from floor seat support RH.
3. Take out the auxiliary control valves (2), hydraulic pipe (1) and quick couplers as a unit.

(When reassembling)

- Take care not to damage the O-rings.

(1) Hydraulic Pipe (2) Auxiliary Control Valves

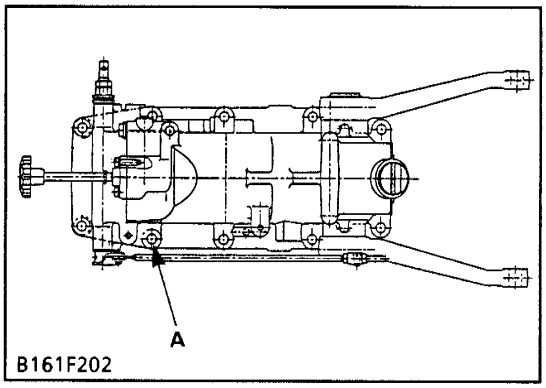

B161P058

Hydraulic Cylinder Assembly

1. Disconnect the draft control rod from the top link bracket. (If equipped.)
2. Disconnect the lift rods from lift arms.
3. Remove the delivery pipe (from front hydraulic block to hydraulic cylinder assembly).
4. Loosen and remove the hydraulic cylinder assembly mounting screws and nut.
5. Support the hydraulic cylinder assembly with nylon lift strap and hoist, and then take out it.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the hydraulic cylinder assembly and transmission case after eliminating the water, oil and stuck liquid gasket.
- When replacing the hydraulic cylinder assembly mounting stud bolts, apply liquid lock (three Bond 1372 or equivalent) to "A" portion of the stud bolt.

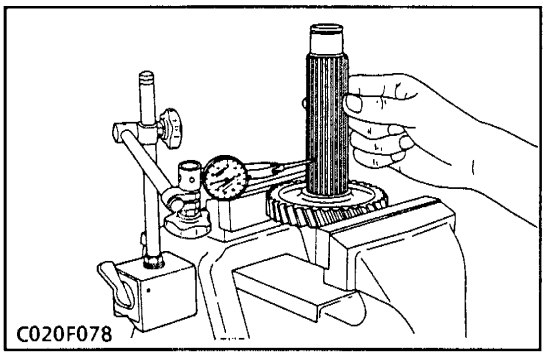


B161F202

Tightening torque	Hydraulic cylinder assembly mounting stud bolts	34.3 to 49.0 N·m 3.5 to 5.0 kgf·m 25.3 to 36.2 ft-lbs
	Hydraulic cylinder assembly mounting screws and nuts	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

■ NOTE

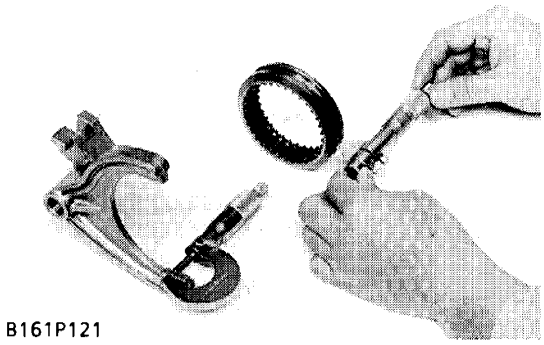
- **Reassemble the hydraulic cylinder assembly to the tractor, be sure to adjust the position control feedback rod and draft control rod (if equipped). (See page 8-S9, S10.)**


C020F078

Clearance between Gear and Spline or Hub and Spline

1. Secure the gear or the hub in a vise.
2. Set a dial gauge (lever type) with its finger on the spline.
3. Move the shaft (or hub) to measure the clearance.
4. If the clearance exceeds the allowable limit, replace them.

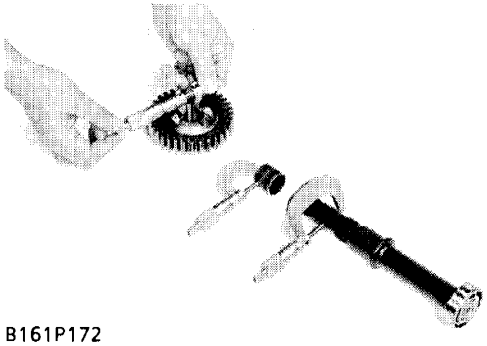
Clearance between gear and spline or hub and spline	Factory spec.	0.030 to 0.078 mm 0.00118 to 0.00307 in.
	Allowable limit	0.2 mm 0.008 in.


B161P121

Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

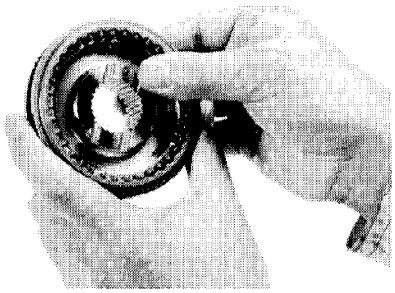
Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.8 mm 0.031 in.


B161P172

Clearance between Gear and Shaft

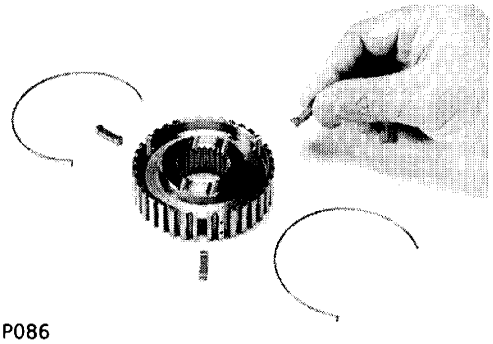
1. Measure the shaft O.D. (rubbing surface).
2. Measure the gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
   (Clearance = Gear I.D. – {(2 × needle O.D.) + shaft O.D.})
5. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and shaft	Factory spec.	0.021 to 0.054 mm 0.00083 to 0.00213 in.
	Allowable limit	0.1 mm 0.004 in.


B161P085

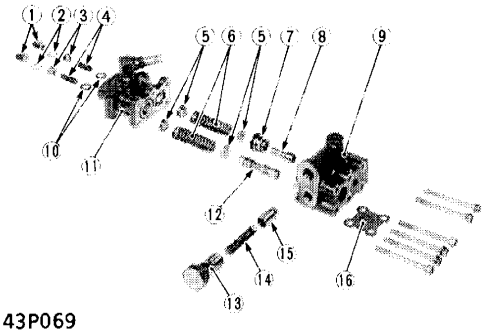
Checking Contact between Coupling and Shifter

1. Check to see if there is any flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.

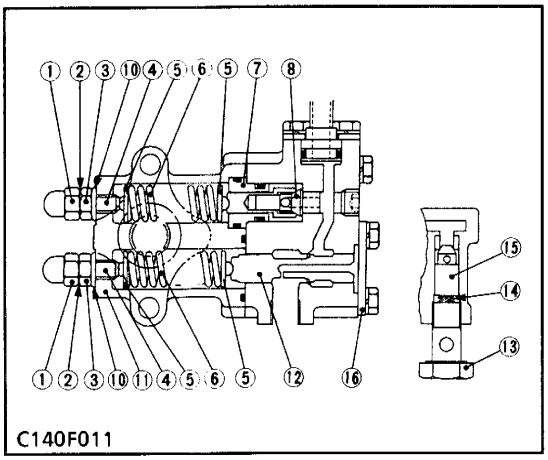

B161P086

Flaw on Synchronizer Key and Spring

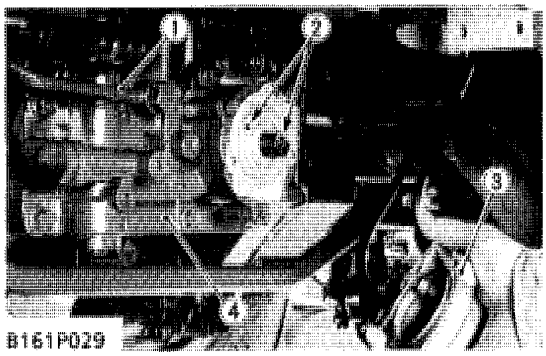
1. Check the projection in the center of the synchronizer key for wear.
2. Check the spring for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.



C143P069



C140F011



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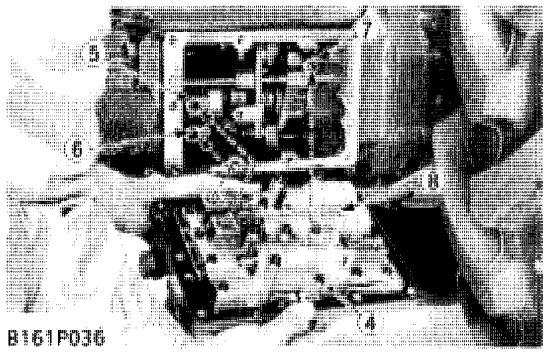


B161P036

(1) GST Delivery Pipe
(2) Punched Mark
(3) Shift Cable
(4) GST Valve
(5) 3-4 Shift Pin
(6) 1-2 Shift Pin
(7) Hi-Lo Shift Pin
(8) Shuttle Check Pin

Regulator Valve

1. Remove the plate (16) and take out reducing spool (12), spring retainer (5) and spring (6).
2. Separate the regulator valve case (9) and regulator support (11).
3. Take out the bush (7) and poppet (8).
4. Remove the joint bolt (13), and then take out the spring (14) and the poppet (15).
5. Take out the spring retainer (5) and spring (6).

(When reassembling)

- Take care not to damage the O-rings.

Tightening torque	Joint bolt (13)	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
	Plate (16)	9.8 N·m 1.0 kgf·m 7.2 ft-lbs
	Regulator valve case and regulator support mounting screws	9.8 N·m 1.0 kgf·m 7.2 ft-lbs

(1) Cap Nuts
(2) Gaskets
(3) Nuts
(4) Adjustor
(5) Spring Retainer
(6) Spring
(7) Bush
(8) Poppet
(9) Regulator Valve Case
(10) Washer with Rubber
(11) Regulator Support
(12) Reducing Spool
(13) Joint Bolt
(14) Spring
(15) Poppet
(16) Plate

GST Valve Assembly

1. Disconnect the GST delivery pipe (1) on the GST valve (4).
2. Remove the shift cable (3).
3. Remove the GST valve (4) as a unit after removing its mounting screws.

■ NOTE

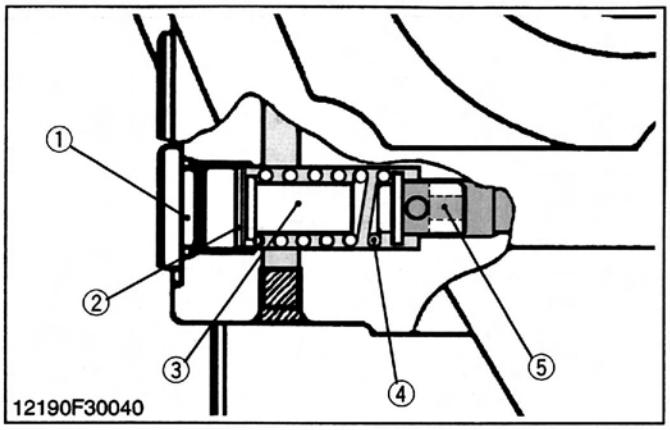
- **Do not fall down the shuttle check pin (8) while disassembling.**

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover and the shift cable (3).
- Set the main shift lever at the neutral position, align the punched marks (2), then assemble the shift cable (3).
- Place the 1-2 (6) and the 3-4 shift pins (5) at neutral position and Hi-Lo shift pin (7) at Hi-shift position (right side), and then assemble the GST valve (4).
- Install the GST valve (4) by hand, and then tighten the screws. Do not use the hummer.

Tightening torque	Joint bolt for GST delivery pipe (1) on GST valve	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Shift cable (3) mounting screws	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft-lbs
	GST valve (4) mounting screws	42.2 to 48.1 N·m 4.3 to 4.9 kgf·m 31.1 to 35.4 ft-lbs

(2)-3 Function of Each Components



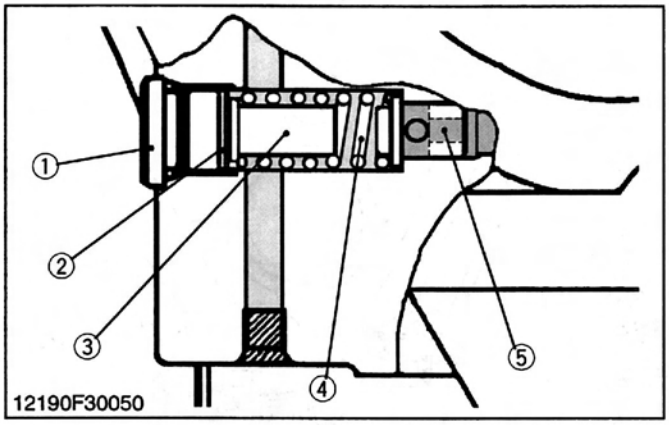
■ Charge Pump and Charge Relief Valve

The charge pump feeds oil to the HST main circuit (closed circuit) and the regulator. Oil may leak out of the HST main circuit (in the HST housing) depending on the pressure, oil temperature and other factors. With this in mind, oil must be constantly fed. The charge relief valve is located on the secondary side of the filter and serves to set the discharge pressure of the charge pump.

Oil temperature	Valve operating pressure
50 °C (122 °F)	2.35 to 2.55 MPa 24 to 26 kgf/cm^2 342 to 370 psi

(1) Plug
(2) Shim
(3) Spring Guide
(4) Spring
(5) Valve Poppet

12190M30050

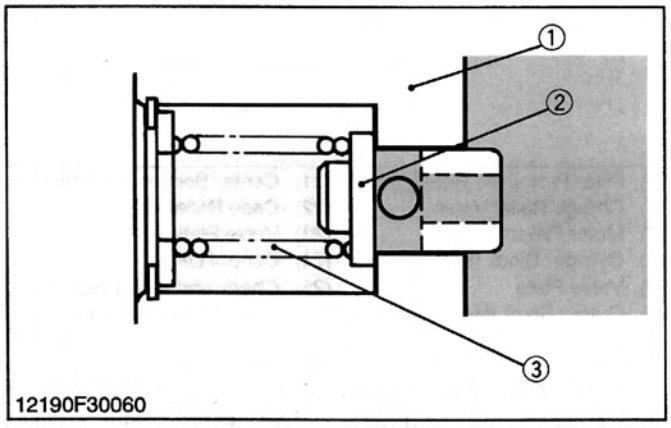


■ Filter Protective Relief Valve

Located on the primary side of the filter, this valve serves to prevent an overpressure that would occur due to a resistance through the filter at a low-temperature start. A setting pressure of this valve is set about 3 kgf/cm^2 (294 kPa, 43 psi) more than charge relief valve setting pressure.

(1) Plug
(2) Shim
(3) Spring Guide
(4) Spring
(5) Valve Poppet

12190M30060

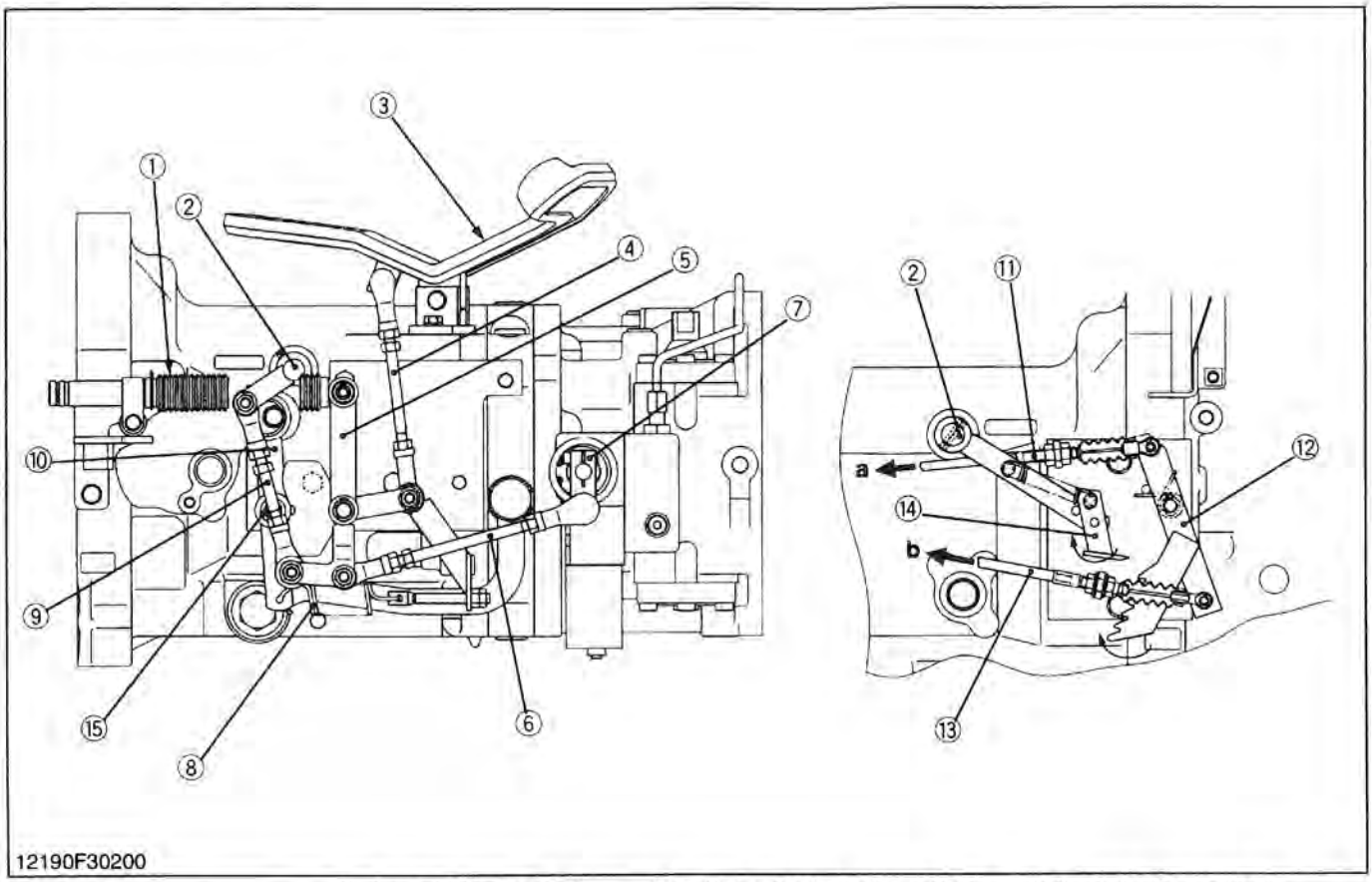


■ Case Relief Valve

The case relief valve monitors the oil pressure in the hydrostatic transmission case. When the oil pressure rised, it opens and flows the oil directly to the transmission case, so that the oil may not leak against the sealings.

12190M30070

(2)-6 Control Linkage



12190F30200

(1) Damper
(2) Connecting Shaft
(3) HST Pedal
(4) Speed Control Rod
(5) Neutral Holder Arm
(6) Neutral Adjusting Rod
(7) HST Control Lever
(8) Neutral Spring
(9) Cruise Control Rod
(10) Neutral Holder
(11) Cruise Control Release Cable (Connected to Brake Pedal)
(12) Cruise Control Arm
(13) Cruise Control Cable (Connected to Cruise Control Lever)
(14) Cruise Control Hook
(15) Ball Bearing
(a) To Brake Pedal
(b) To Cruise Lever

The speed control pedal (HST pedal) (3) and the HST control lever (7) are linked with the speed control rod (4), neutral holder arm (5) and neutral adjusting rod (6).

As the front footrest of the pedal is depressed, the HST control lever (7) is rotated, then the swashplate is tilted by servomechanism and forward travelling speed increases.

Then, the swashplate is returned to neutral with the neutral holder arm (5), when the pedal is released. The ball bearing (15) on the neutral holder (10) pulled with the neutral spring (8) seats the detent of the neutral holder arm (5) so that the neutral holder arm returns to neutral.

The damper (1) is connected to the HST pedal (3) through speed control rod (4) and neutral holder arm (5), restricts the movement of the linkage to prevent abrupt operation or reversing.

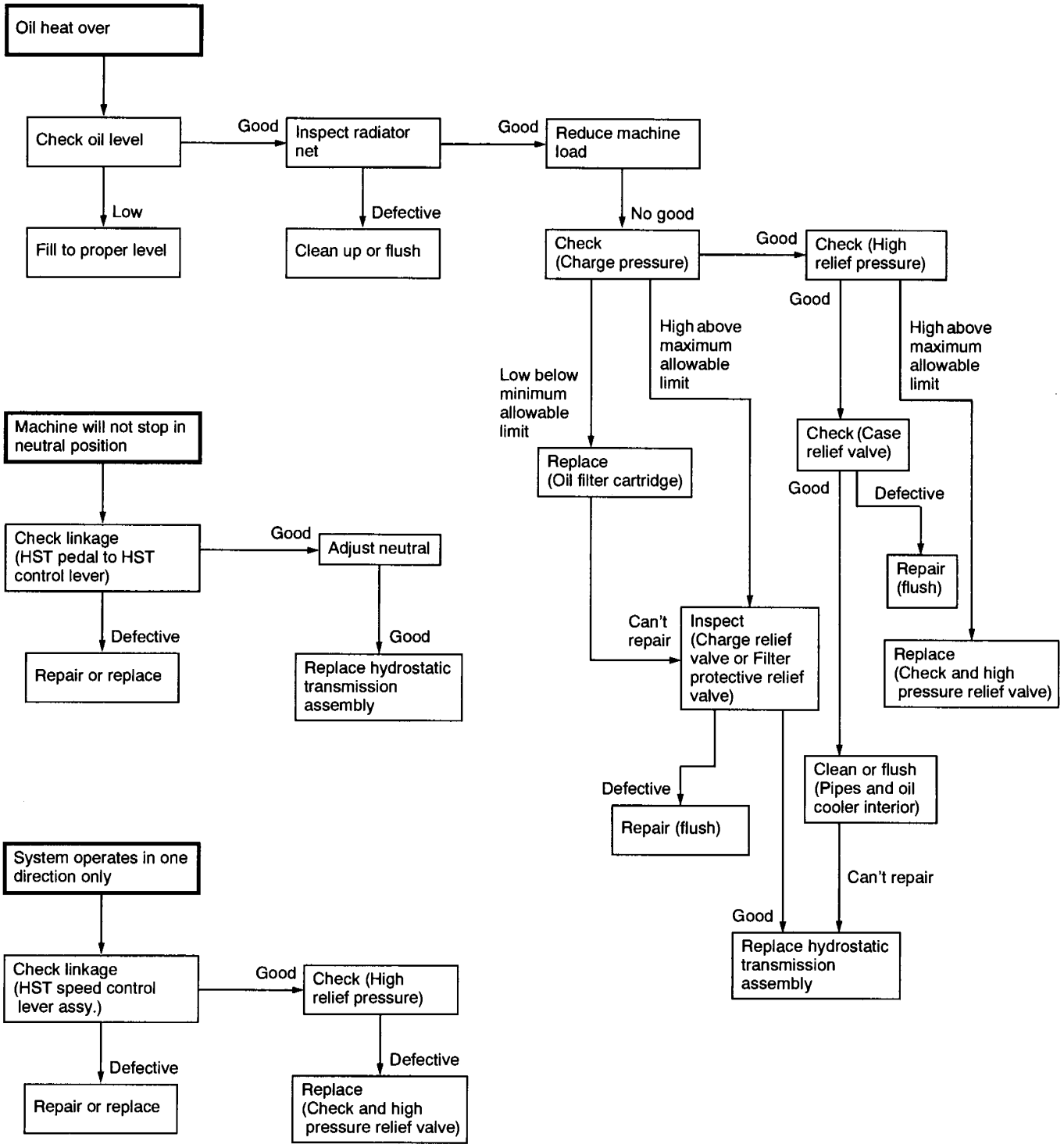
The cruise control lever (speed set lever) linked to the HST pedal enables the linkage not to return to neutral and keep a certain forward speed while the HST pedal is released.

The HST pedal (3) and the cruise control hook (14) are linked with the speed control rod (4), neutral holder arm (5), cruise control rod (9) and connecting shaft (2). The cruise control lever is connected to cruise control arm (12) through cruise control cable (13).

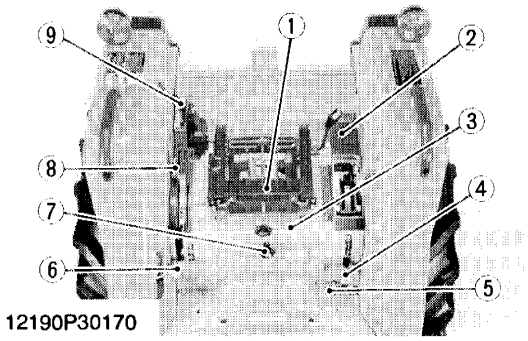
When the front footrest of the pedal is depressed and cruise control lever is pushed, the cruise control arm (12) and cruise control hook (14) are moved in the direction of arrow shown in figure above. The result was that speed is set. The cruise control arm (12) is also connected with brake pedal through cruise control release cable (13), so it can be released while depressed brake pedal.

12190M30190

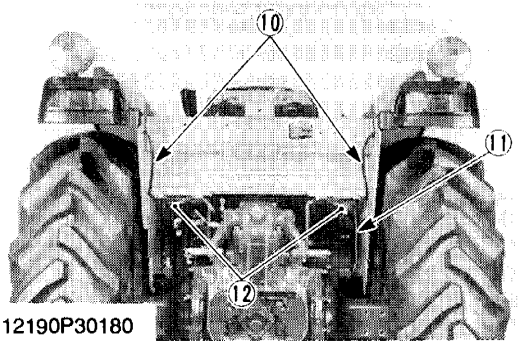
TROUBLESHOOTING (CONTINUED)



12190S30030



12190P30170



12190P30180

Preparation 2

1. Remove the seat base (1).
2. Remove the lever grip for front wheel drive lever (4), Mid PTO shift lever (6), lowering speed adjusting lever (7) and hydraulic position control lever (8).
3. Remove the range gear shift lever guide (2).
4. Remove the seat under cover (3) and then remove the extension rod of the lowering speed adjusting valve lever (7).
5. Disconnect the differential lock pedal (5) from the differential lock rod.
6. Disconnect the rear PTO shift cable (11) and safety switch connector at the rear PTO shift lever (9) side.
7. Remove the Mid PTO shift lever (6).
8. Remove the auxiliary control valve lever grips and the quick couplers as a unit. (If equipped.)
9. Disconnect the wiring harness (10) for hazard light and combination light.
10. Loosen and remove the floor seat mounting bolt and nut (12) and platform mounting bolt and nut.

(When reassembling)

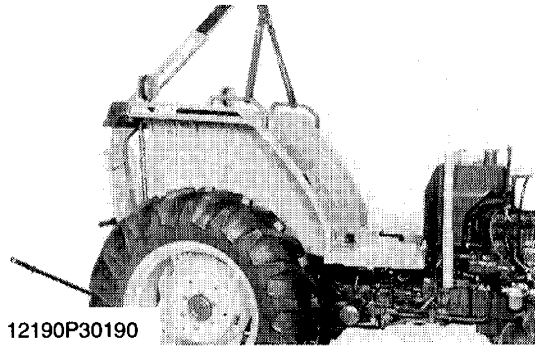
Tightening torque	Floor seat and platform mounting bolt and nut	197 to 226 N·m 20 to 23 kgf·m 145 to 166 ft-lbs

(1) Seat Base
(2) Range Gear Shift Lever Guide
(3) Seat Under Cover
(4) Front Wheel Drive Lever
(5) Differential Lock Pedal
(6) Mid PTO Shift Lever
(7) Lowering Speed Adjusting Lever
(8) Position Control Lever
(9) Rear PTO Shift Lever
(10) Wiring Harness
(11) PTO Shift Cable
(12) Floor Seat Mounting Bolt and Nut

12190S30200

Fender, Floor Seat and Platform Assembly

1. Remove the fender, floor seat and platform.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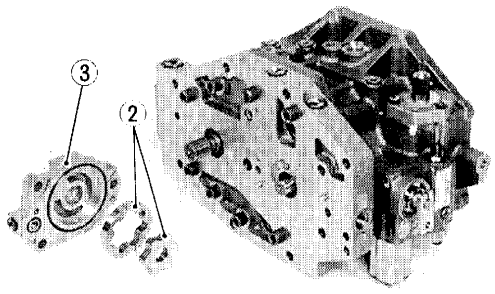
12190S30210



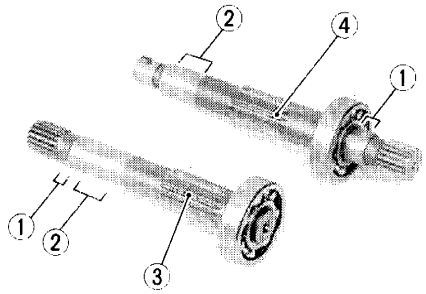
12190P30340

Charge Pump

1. Check the charge pump housing (2) and the gerotor assembly (1) for scratches and wear.
2. If scratch or worn, replace the charge pump complete assembly.

(1) Gerotor Assembly
(2) Charge Pump Housing

12190S30400



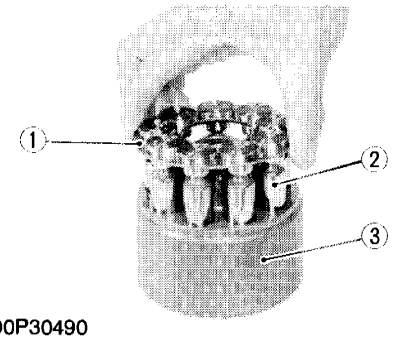
12190P30480

Pump Shaft and Motor Shaft

1. Check the seal surface (1) and the bearing surface (2).
2. If the shaft is rough or groove, replace it.

(1) Seal Surface
(2) Bearing Surface
(3) Motor Shaft
(4) Pump Shaft

12190S30410



12190P30490

Cylinder Block Bore and Pistons

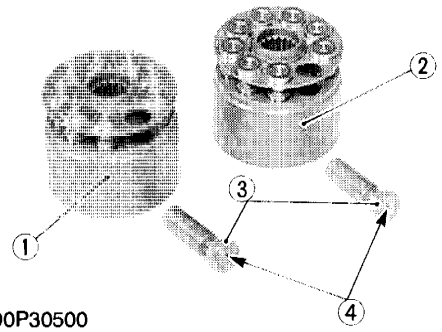
1. Lift all the pistons gently with the retainer plate (1).
2. Check the pistons for their free movement in the cylinder block bores.
3. If the piston or the cylinder block bore is scored, replace cylinder block assembly.

■ IMPORTANT

- **Do not interchange pistons between pump and motor cylinder block.**

(1) Retainer Plate
(2) Piston
(3) Cylinder Block

12190S30420



12190P30500

Piston Slipper

1. Check the slipper (3) for flatness.
2. If rounded, replace.
3. Measure the thickness of piston slipper.
4. If the measurement is less than the allowable limit, replace.
5. Check the lubricant hole (4) for clogging.

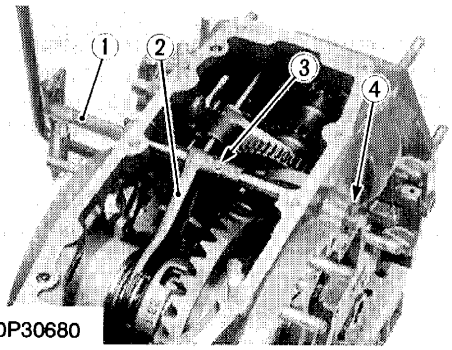
■ IMPORTANT

- **Do not interchange pistons between pump and motor cylinder block.**

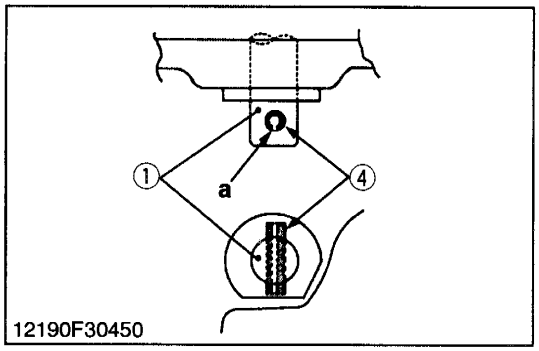
(1) Pump Cylinder
(2) Motor Cylinder
(3) Piston Slipper
(4) Lubricant Hole

12190S30430

(7) Disassembling Transmission Case



12190P30680



12190F30450

Differential Lock Shift Fork

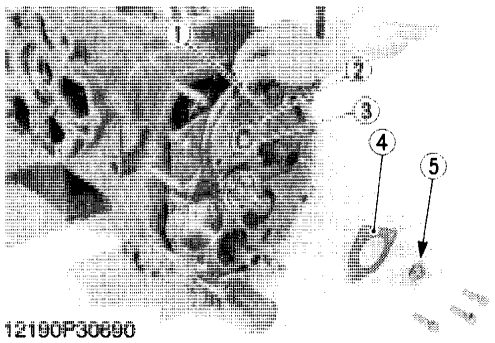
1. Tap out the left side spring pin (4).
2. Remove the cotter pin and take out the clevis pin (3).
3. Draw out the differential lock fork shaft (1) and take out the differential lock shift fork (2).

(When reassembling)

- Apply grease to the left and right oil seals on the transmission case.
- Insert the clevis pin (3) from the bottom and install the washer and cotter pin.
- Tap in the spring pin (4) so that its split portion **(a)** may face outward as shown in the figure.

(1) Differential Lock Fork Shaft
(2) Differential Lock Shift Fork
(3) Clevis Pin
(4) Spring Pin
(a) Split Portion

12190S30610



12190P30690

Pinion Bearing Cover

1. Remove the stake of lock nut (5).
2. Remove the lock nut (5).
3. Remove the pinion bearing case mounting screws.
4. Take out the pinion bearing cover (4) and shims (1).

(When reassembling)

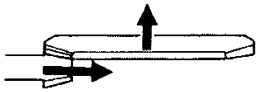
- Make sure of the number of shims in the pinion bearing case.
- Replace the lock nut (5) with a new one, and stake the lock nut firmly after installing the parts on the shaft.

Tightening torque	Lock nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft-lbs
	Pinion bearing case mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

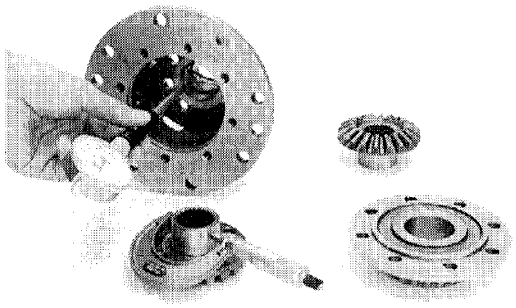
(1) Shim
(2) Pinion Bearing Case
(3) Spiral Bevel Pinion
(4) Pinion Bearing Cover
(5) Lock Nut

12190S30620

■ Tooth Contact Instructions

[Proper Contact]  11790F30160	More than 35 % red lead contact area on the gear tooth surface. The center oftooth contact at 1/3 of the entire width from the small end.
[Shallow Contact]  **[Heel Contact]**   11790F30170	Replace adjusting shim (2) with thicker one to move the spiral bevel pinion shaft backward. For move the spiral bevel gear rightward, redurce right side shim (5) and add shim (6) of the same thickness as the right side to left side.
[Deep Contact]   **[Toe Contact]**  11790F30180	Replace adjusting shim (2) with thinner one to move the spiral bevel pinion shaft forward. For move the spiral bevel gear leftward, reduce left side shim (6) and add shim (5) of the same thickness as the left side to right side. Repeat above until the proper tooth contact and backlash are achieved.

12190S30770



11790P30440

Clearance between Differential Case Bore (Differential Case Cover Bore) and Differential Side Gear Boss

1. Measure the bore I.D. of the differential case and differential case cover.
2. Measure the differential side gear boss O.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential case bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.

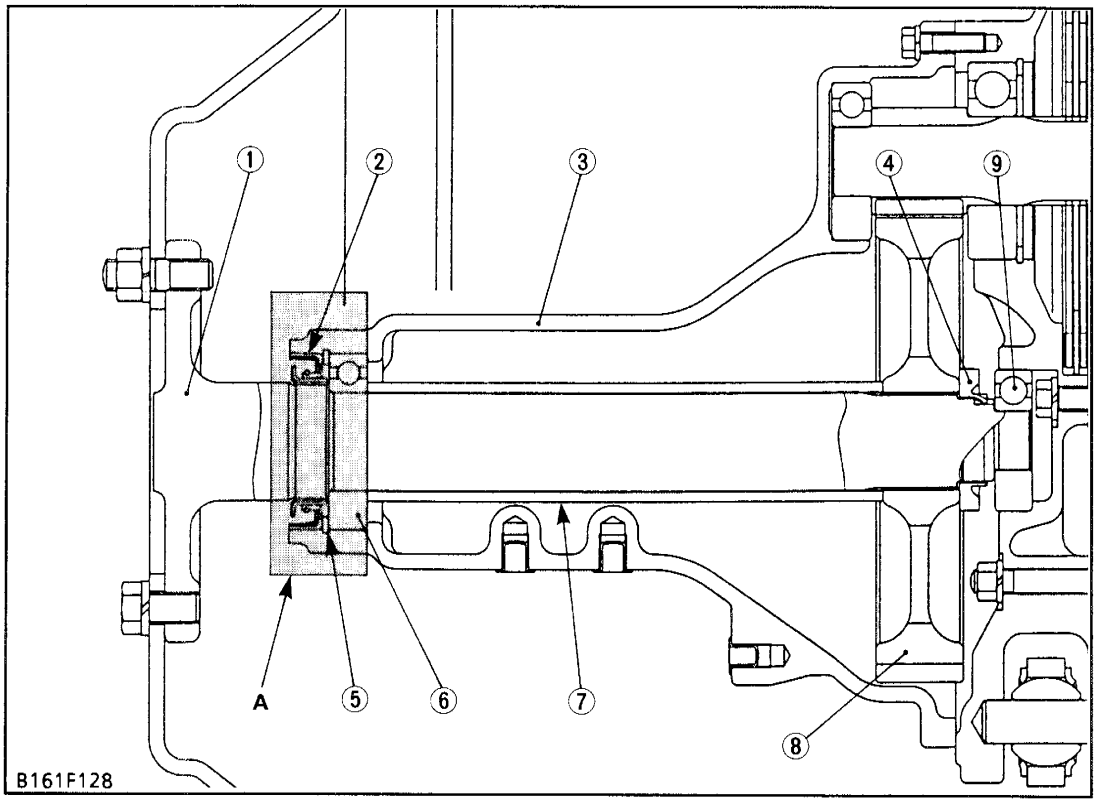
Differential case bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.

Clearance between differential case cover bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.

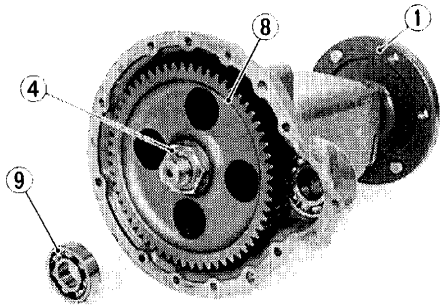
Differential case cover bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.

11790S30440

(2) Disassembling Rear Axle



(1) Rear Axle
(2) Oil Seal
(3) Rear Axle Case
(4) Lock Nut
(5) Internal Snap Ring
(6) Ball Bearing
(7) Spacer
(8) Gear
(9) Ball Bearing



0329P104

[A] Oil Seal Portion

(1) Rear Axle
(4) Lock Nut
(8) Gear
(9) Ball Bearing

Rear Axle

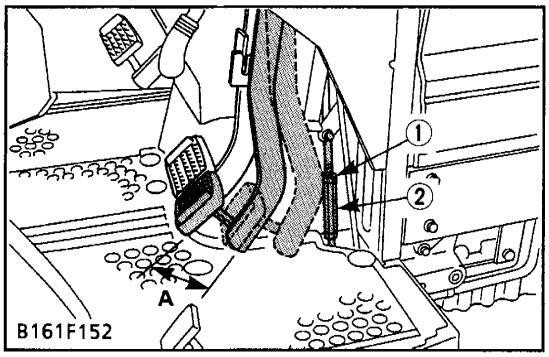
1. Remove the ball bearing (9) with a puller.
2. Remove the stake of lock nut (4).
3. Secure the rear axle (1) in a vise and remove the lock nut.
4. Take out the gear (8) and spacer (7).
5. Tap out the rear axle (1).

(When reassembling)

- Apply grease to the oil seal (2) and install it.
- Replace the lock nut with new one, and after tightening it to specified torque, stake it firmly.
- Assemble the oil seal (2) with correct direction. (See figure above (A) portion.)

Tightening torque	Lock nut	196 to 245 N·m 20 to 25 kgf·m 145 to 181 ft-lbs

CHECKING AND ADJUSTING



[A] Free Trevel

(1) Lock Nut (2) Turnbuckle

Checking Brake Pedal Free Travel

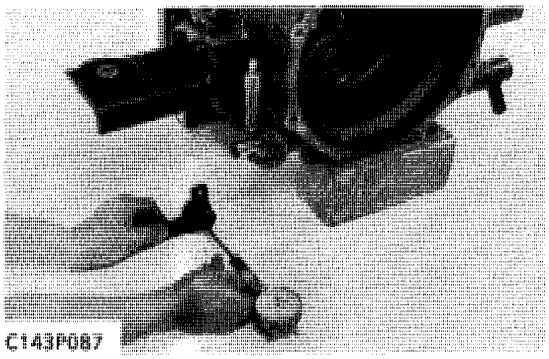
⚠ CAUTION

- **Stop the engine and remove the key, then chock the wheels before checking brake pedal.**

1. Release the parking brake.
2. Slightly depress the brake pedals and measure free travel at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut (1) and adjust with the turnbuckle (2).
4. Retighten the lock nut (1).

Brake pedal free travel	Factory spec.	15 to 20 mm (0.6 to 0.8 in.) on the pedal
	Factory spec.	Keep the free travel in the right and left brake pedals equal

SERVICING



Clearance between Brake Lever Link Shaft and Bushing

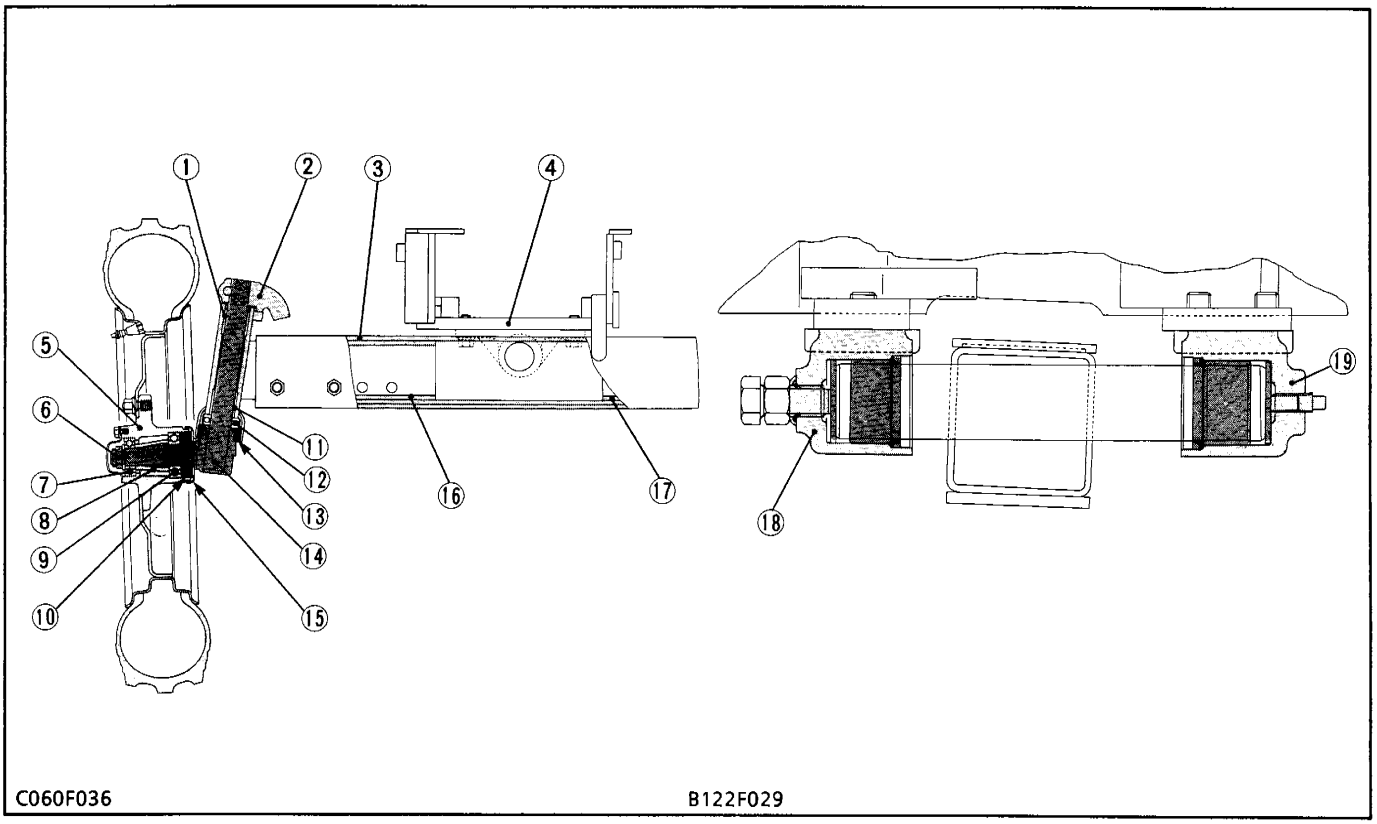
1. Measure the brake lever link shaft O.D. with an outside micrometer.
2. Measure the brake lever link bushing I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between brake lever link shaft and brake lever link bushing	Factory spec.	0.125 to 0.195 mm 0.00492 to 0.00768 in.
	Allowable limit	1.0 mm 0.039 in.
Brake lever link shaft O.D.	Factory spec.	19.955 to 19.975 mm 0.78563 to 0.78642 in.
Brake lever link bushing I.D.	Factory spec.	20.100 to 20.150 mm 0.79134 to 0.79331 in.

[1] STRUCTURE

The front axle supports the front of tractor and facilitates steering. There are two kinds of front axles. The two wheel drive axle has free-running front wheels and the four wheel drive axle has powered front wheels.

(1) 2WD Type

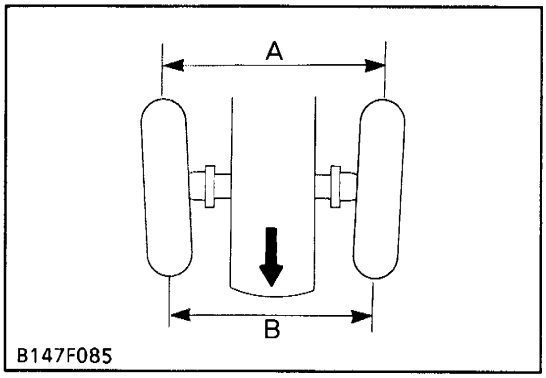


(1) Bushing
(2) Knuckle Arm
(3) Front Axle Middle
(4) Front Axle Frame
(5) Front Wheel Hub
(6) Slotted Nut
(7) Ball Bearing
(8) Spacer
(9) Ball Bearing
(10) Oil Seal
(11) Bushing
(12) Thrust Ball Bearing
(13) Oil Seal
(14) Knuckle Shaft
(15) Dust Cover
(16) Front Axle Right
(17) Front Axle Left
(18) Front Axle Bracket, Front
(19) Front Axle Bracket, Rear

The front axle of the 2WD type is constructed as shown above. The shape of the front axle is relatively simple, and the front axle is supported at its center with the front axle brackets (18), (19) on the front axle frame (4), so that steering operation is stable even on uneven grounds in a farm field.

CHECKING, DISASSEMBLING AND SERVICING

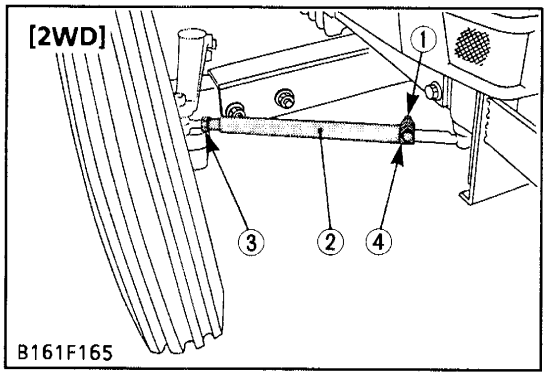
CHECKING AND ADJUSTING



Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (**A-B**).
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

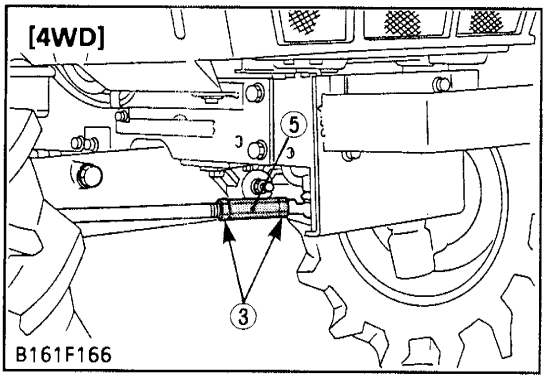
Toe-in (**A-B**)	Factory spec.	2 to 8 mm 0.08 to 0.32 in.



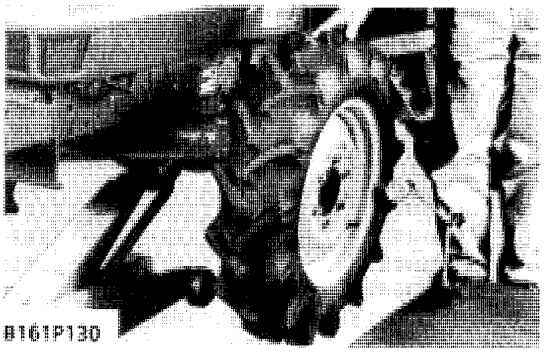
Toe-in Adjustment

1. Remove the tie-rod clamp nut (1) and its screw. (2WD)
2. Loosen the lock nuts (3).
3. Turn the turnbuckle (2), (5) until to be factory specification.
4. Tighten the tie-rod clamp nut (1) after reinstalling them. (2WD)
5. Tighten the lock nuts (3).

Tightening torque	Tie-rod clamp screw and nut (2WD)	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 ft-lbs



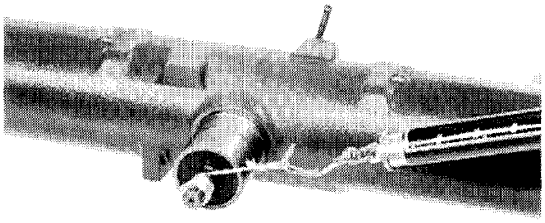
(1) Tie-rod Clamp Nut
(2) Turnbuckle
(3) Lock Nut
(4) Tie-rod Clamp
(5) Turnbuckle



Axial Sway of Front Wheel

1. Jack up the front side of tractor.
2. Set a dial gauge on the outside of rim.
3. Turn the wheel slowly and read the runout of rim.
4. If the runout exceeds the factory specifications, check the bearing, rim, and front wheel hub.

Axial sway of front wheel	Factory spec.	Less than 5.0 mm 0.20 in.



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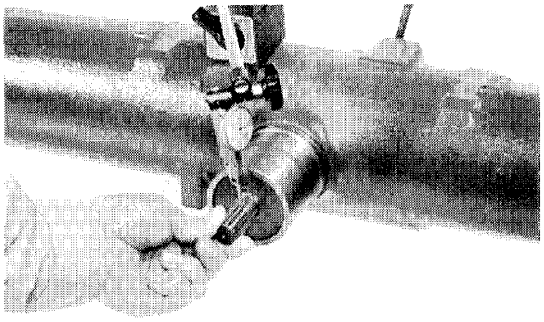
Turning Force of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

Turning force	Factory spec.	98.1 to 117.7 N 10 to 12 kgf 22.0 to 26.5 lbs

■ **NOTE**

- **The turning torque is figured by multiplying the radius (distance from the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.**
- **After turning torque adjustment, be sure to stake the lock nut.**

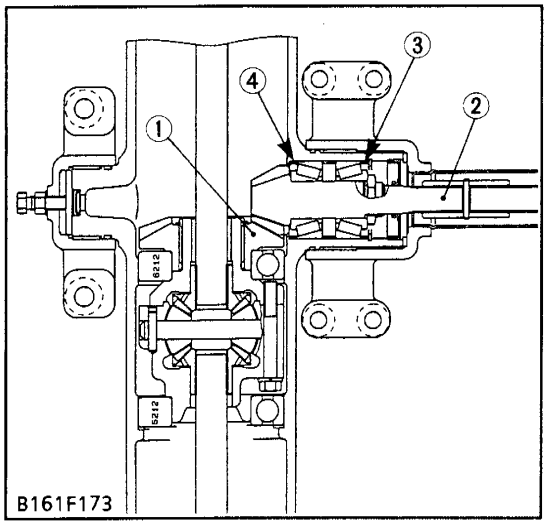


B161P137

Backlash between Spiral Bevel Pinion Shaft and Spiral Bevel Gear

1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, change the adjusting collars (3), (4). Change the adjusting collar (4) to 0.1 mm (0.004 in.) smaller size, and change the adjusting collar (3) to 0.1 mm (0.004 in.) larger size.
4. Adjust the backlash properly by repeating the above procedures.

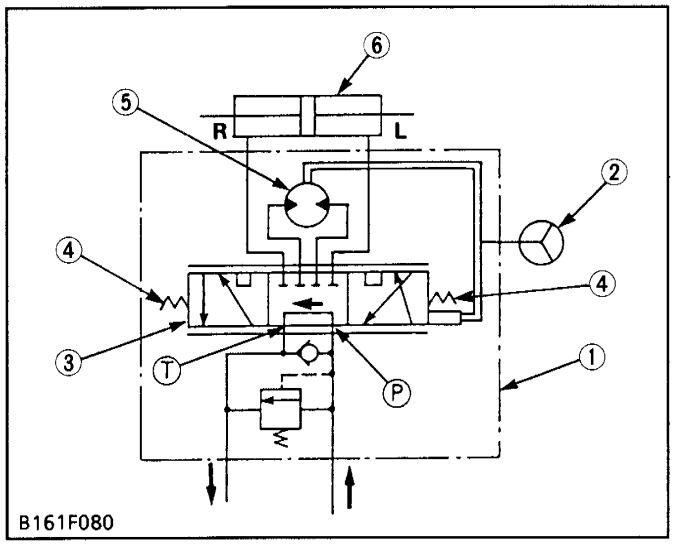
Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.



B161F173

(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Adjusting Collar
(4) Adjusting Collar

[5] OIL FLOW



B161F080

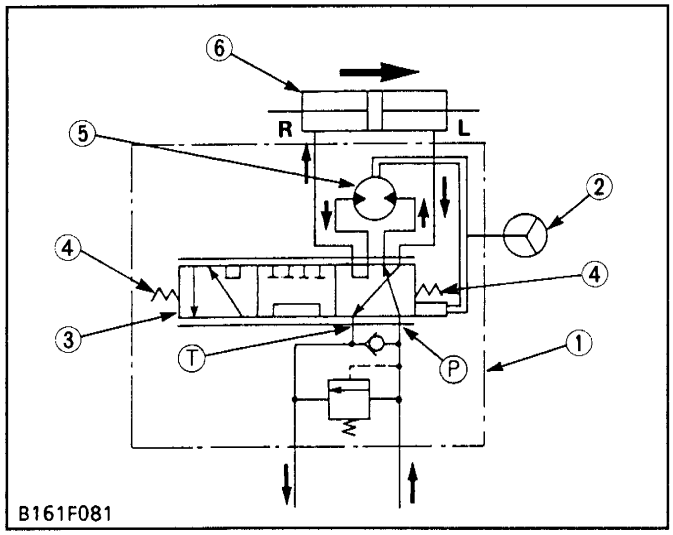
■ Neutral Position

When the steering wheel (2) is not being turned, valve plate (3) is held in the neutral position by centering springs (4). Under this condition, an oil passage is formed between port **P** (from pump) and port **T** (to transmission case) in the control valve, and all oil from the hydraulic pump flows to port **T**.

Also, the passage from cylinder ports **R** and **L** are closed off in the control valve. Consequently, steering cylinder does not operate even if subjected to an external force, and the front wheels are held in the straight ahead position, or an a given angle of turn.

P : Pump Port **R : Cylinder Port R**
T : Tank Port **L : Cylinder Port L**

(1) Steering Controller (4) Centering Spring
(2) Steering Wheel (5) Gerotor
(3) Valve Plate (7) Steering Cylinder



B161F081

P : Pump Port **R : Cylinder Port R**
T : Tank Port **L : Cylinder Port L**

(1) Steering Controller (4) Centering Spring
(2) Steering Wheel (5) Gerotor
(3) Valve Plate (6) Steering Cylinder

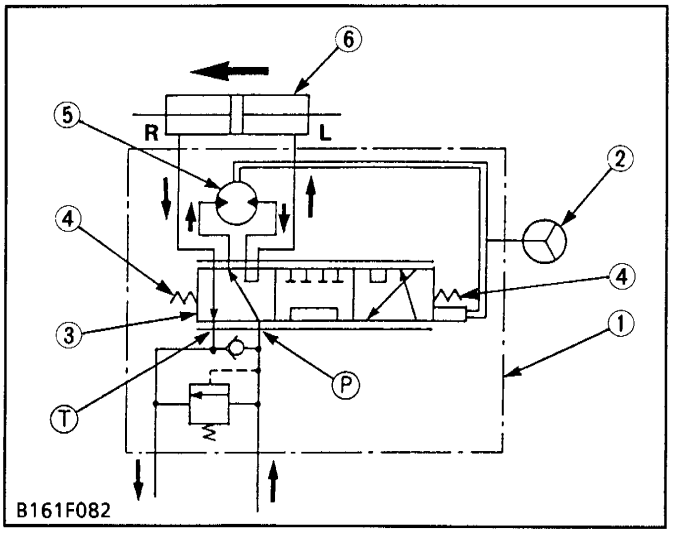
■ Right Turn

When the steering wheel is turned to the right, the action is transmitted through the drive plate, gerotor, and drive link to the control valve. Valve plate (3) then rotates to the right on manifolds, located on the opposite faces of the valve plate (3). Thus, the port **P** passage in the control valve is connected with gerotor (5).

The stator of gerotor (5) turns by the amount corresponding to the turn of the steering wheel (2), and the gerotor performs the metering function and lets oil through it, the amount of which corresponds to the turn of the steering wheel (2).

The oil which has passed through gerotor (5) flows back to the control valve, in which it is directed to cylinder port **R** to operate steering cylinder (6). Consequently, the front wheels are moved to the right through the angle corresponding to the amount of the oil.

When steering cylinder (6) operates, oil returning to cylinder port **L** flows back to the transmission case through the passage connected to port **T** in the control valve.



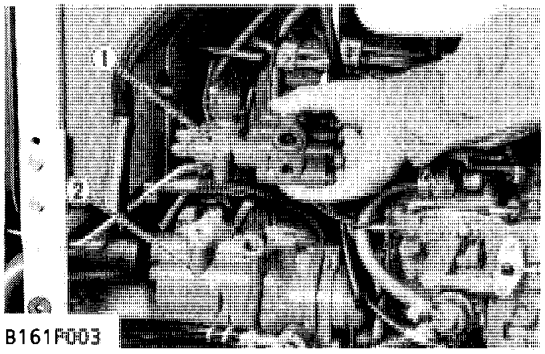
B161F082

■ Left Turn

The steering system operates in the same way at a left-turn as well, except that oil flows into and out of steering cylinder in the directions opposite to those at a right-turn.

P : Pump Port **R : Cylinder Port R**
T : Tank Port **L : Cylinder Port L**

(1) Steering Controller (4) Centering Spring
(2) Steering Wheel (5) Gerotor
(3) Valve Plate (6) Steering Cylinder



B161P003

Regulator Valve

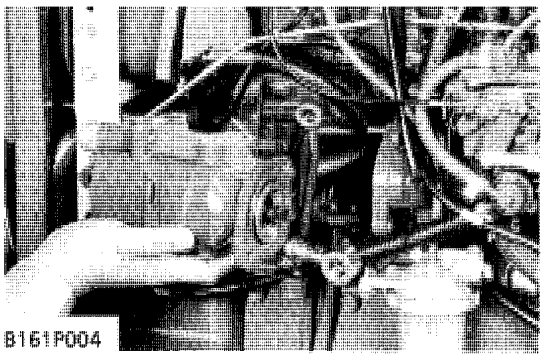
1. Loosen and remove the regulator valve mounting screws.
2. Take out the regulator valve (1) from the power steering hydraulic pump (2).

(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Regulator valve mounting screws	17.6 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

(1) Regulator Valve (2) Power Steering Hydraulic Pump


B161P004

Removing Hydraulic Pump Assembly

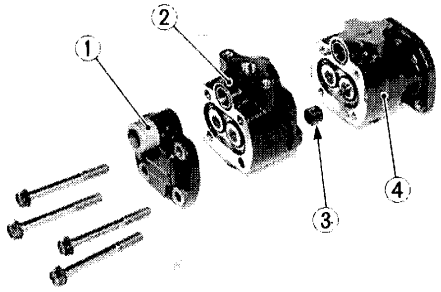
1. Loosen and remove the hydraulic pump assembly mounting screw and nut.
2. Take out the hydraulic pump assembly.

(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Hydraulic pump assembly mounting screw and nut	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(2) Disassembling Power Steering Hydraulic Pump



B161P005

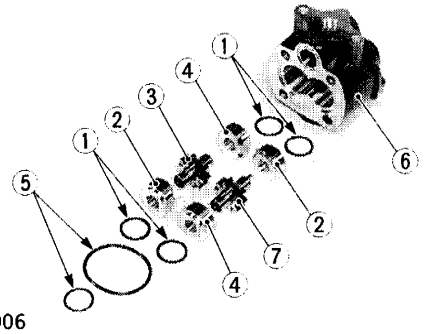
Separating Power Steering Hydraulic Pump

1. Remove the pump cover mounting four screws.
2. Separate the power steering hydraulic pump (2) from the three point system hydraulic pump (4).

(When reassembling)

- Take care not to damage the O-ring.

(1) Pump Cover
(2) Power Steering Hydraulic Pump
(3) Coupling
(4) Three Point System Hydraulic Pump



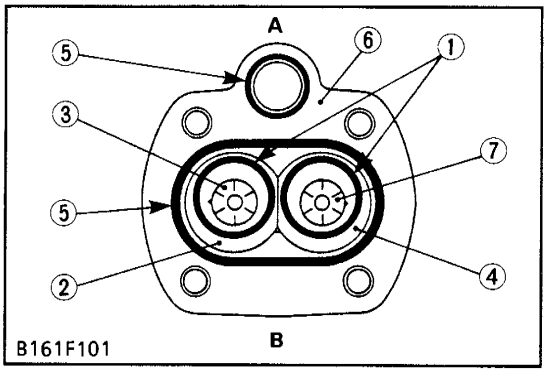
B161P006

Disassembling Power Steering Hydraulic Pump

1. Remove the O-ring (5) and seal ring (1).
2. Remove the bushings (2), (4) of cover side as a unit.
3. Take out the drive gear (7) and driven gear (3).
4. Take out the bushings (2), (4) in back of pump housing (6) as a unit.

(When reassembling)

- Install the driven gear (3), noting its original direction.
- When installing the bushings (2), (4), be sure to reassemble them to the each original position.
- Take care not to damage the seal rings and O-rings.
- After reassembling the hydraulic pump assembly, mount an arm approx. 100 mm (3.39 in.) long to the drive gear to check for smooth rotation.



B161F101

[A] Inlet **[B] Outlet**

(1) Seal Ring
(2) Bushing
(3) Driven Gear
(4) Bushing
(5) O-ring
(6) Pump Housing
(7) Drive Gear